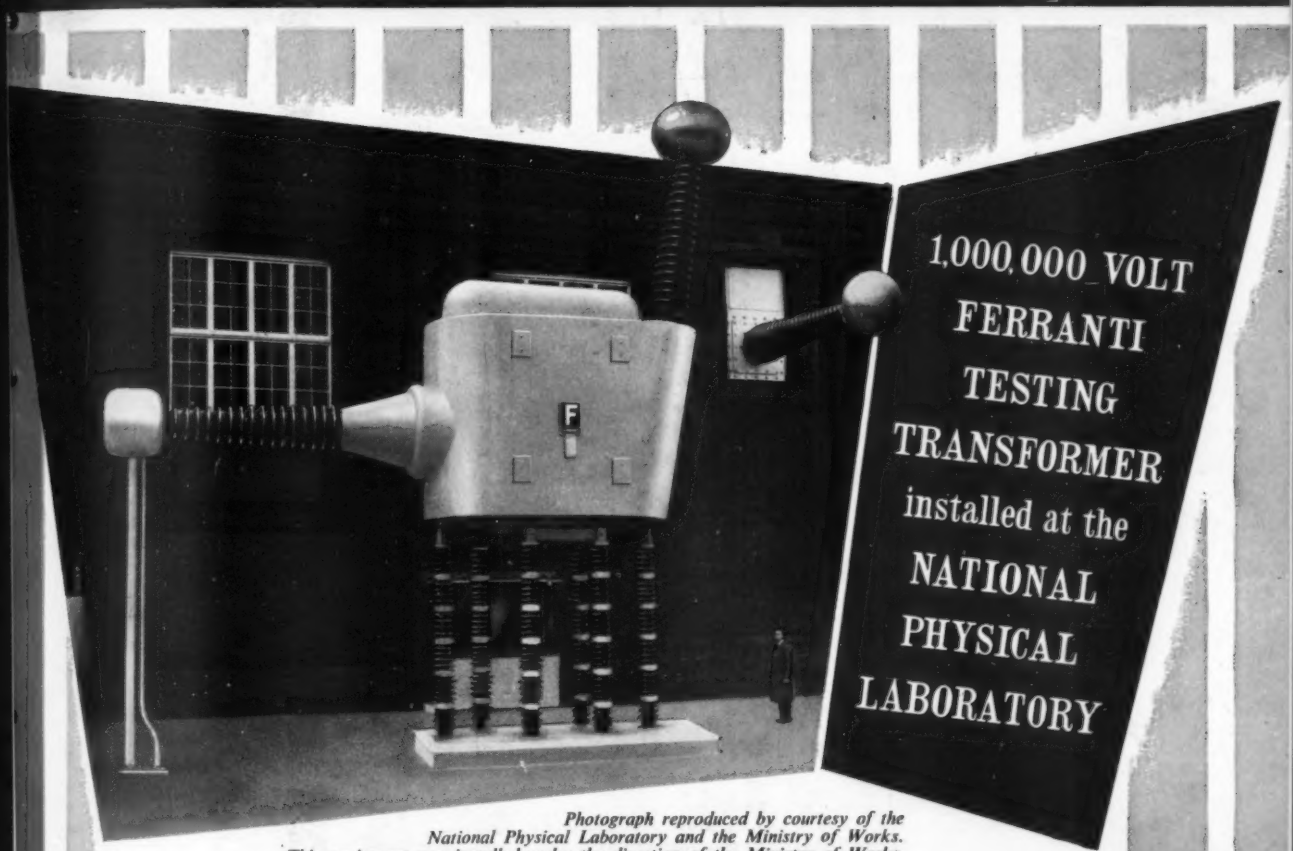
ELECTRICAL REVIEW

FEBRUARY 1958 PRICE 1s 6d



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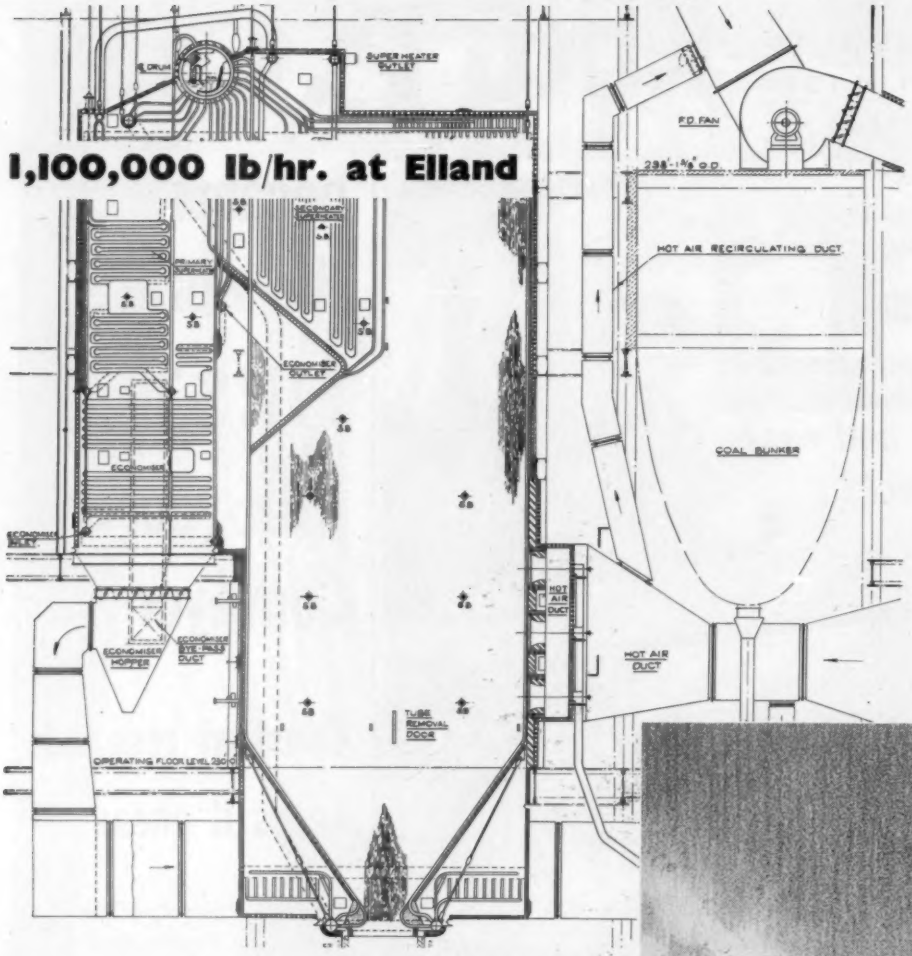

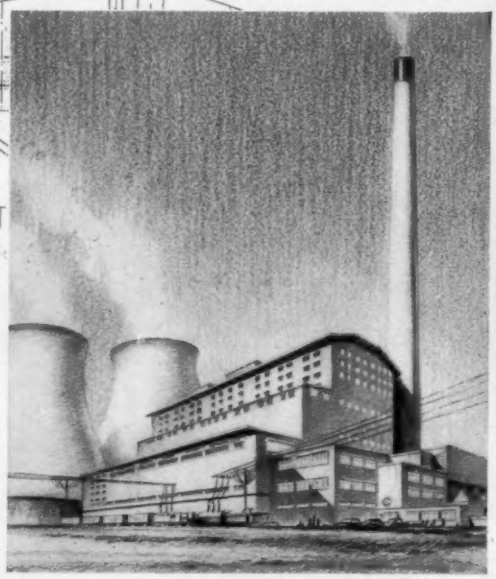

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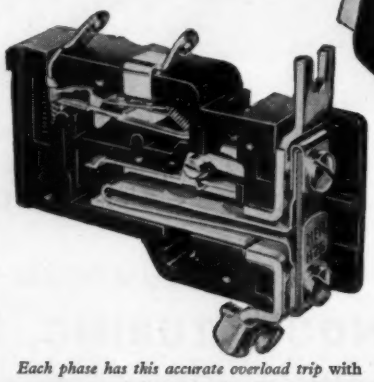

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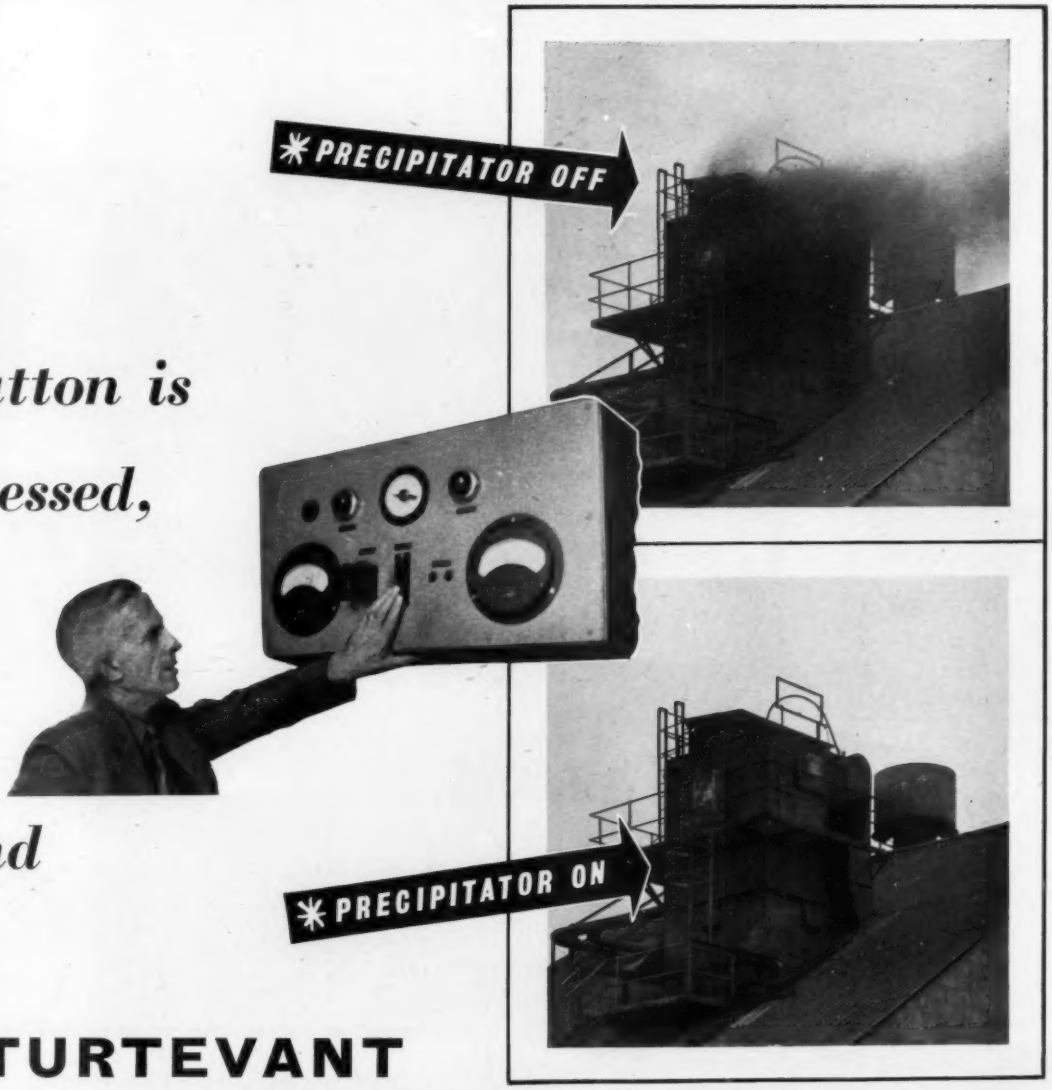

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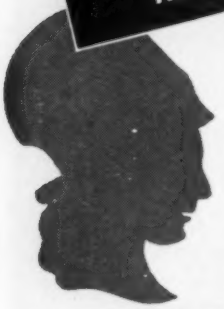

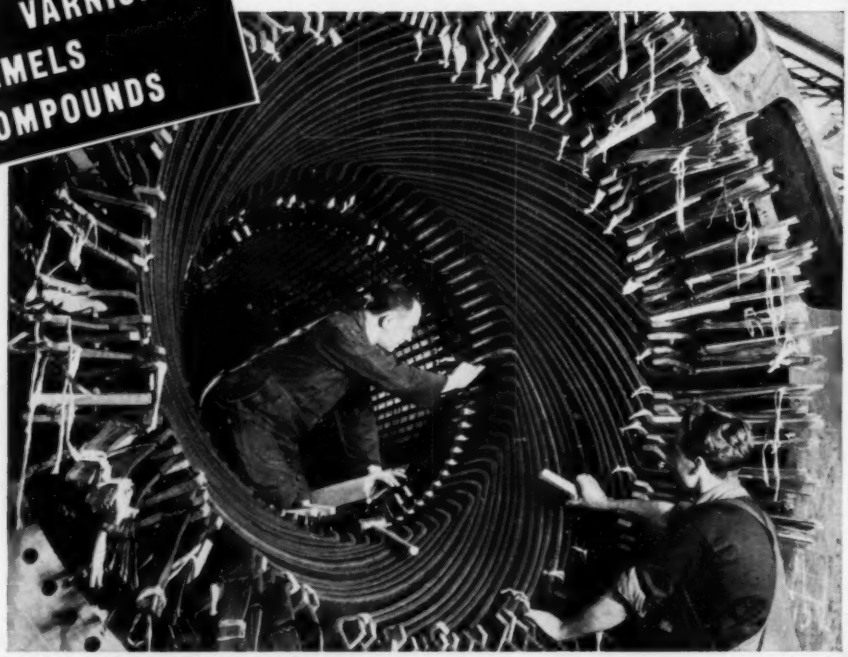

A Stator under construction

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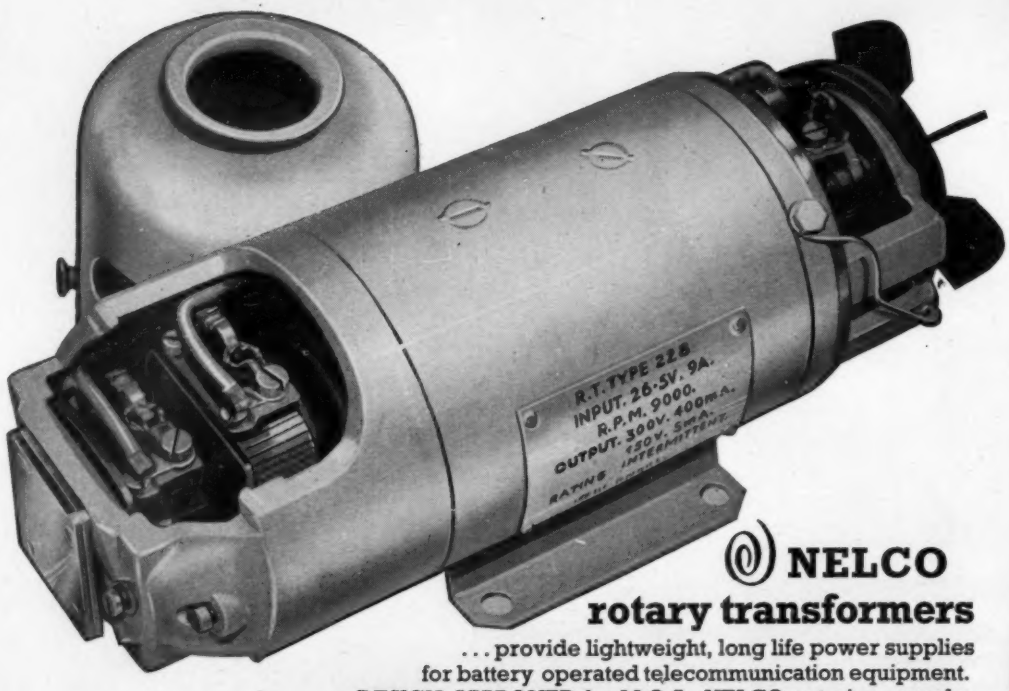

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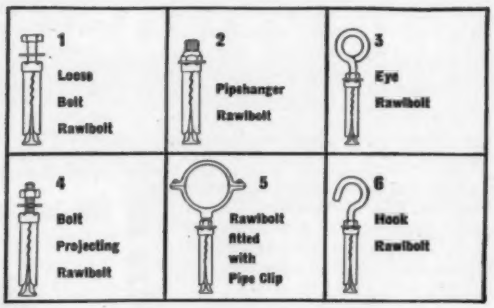

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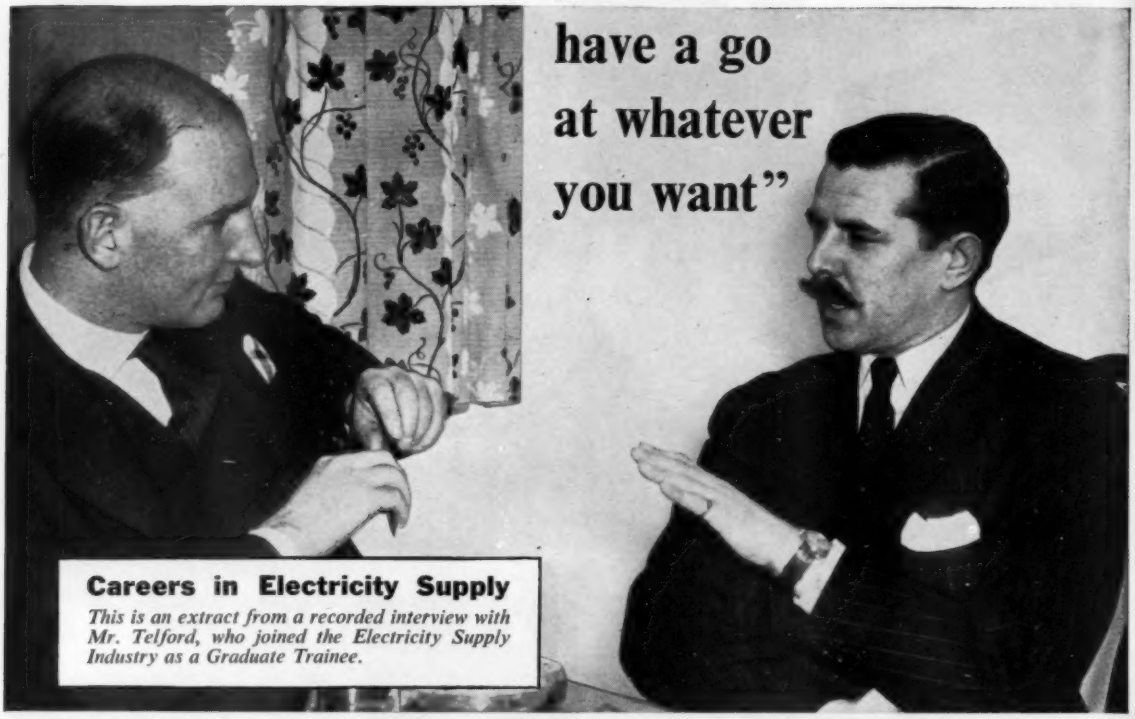


Careers in Electricity Supply

This is an extract from a recorded interview with Mr. Telford, who joined the Electricity Supply Industry as a Graduate Trainee.

E.S.I. Question Master — *Mr. Telford.*

Question Master: **I think we might begin by asking what was your first job in Electricity Supply after your training was finished ?**

Mr. Telford: Well, my training was interrupted by the war, and it was only in 1950 that I finished my graduate course in the industry. I was then appointed Shift Charge Engineer at Frome, Somerset—a small station but an excellent training ground. From there I went to Earley—a much bigger station of 120 megawatts—as Boiler House Shift Engineer; later I became Charge Engineer there, and for a while was Efficiency Engineer, as well.

Q.M.: **Your next step was London, wasn't it ?**

Telf: Yes, I came to London as Second Assistant Engineer on the Divisional Staff, and later I was appointed Deputy Superintendent at Bankside Generating Station—the position which I hold now.

Q.M.: **Bankside is a pretty big station, and at 36 you're young, aren't you, to be a Deputy Superintendent ? But what made you come to London in the first place ?**

Telf: A chance came along to get some administrative experience at H.Q. level, and I thought I'd better take it.

Q.M.: **Does the Industry give many opportunities like that ?**

Telf: It most certainly does. It gives you a complete opportunity to have a go at whatever you want, and what you think you're best equipped for. The man who wants to get on is helped in every possible way; I've attended several courses run by the Industry, not only on technical matters, but on subjects like personnel selection and industrial relations.

Q.M.: **You find your job gives you scope for managerial ability—dealing with people as well as machines ?**

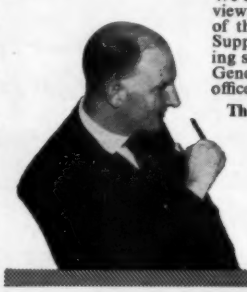
Telf: Yes, indeed. I don't think there are many better opportunities than in a power station, because you have something of everything. You have the mechanical side, the electrical side, the building side—and most of all, a number of people with varied interests and jobs.

Q.M.: **Now a word about newcomers to the industry. If you have a chap of ability who is prepared to get down to the task, what would you say his opportunities were like?**

Telf: I would say that he has really splendid opportunities. For one thing, a career in the industry is established on a very firm footing—you could do without a lot of things, but it's impossible to get on nowadays without electrical energy. Another point worth remembering is that a man coming into the industry has the choice of the entire country to work in, and there's no parochial approach.

We'd like to publish more of this interview, but there isn't space. For details of the many careers in the Electricity Supply Industry and the salaried training schemes available ask at your local Generating or Distribution Board's offices, or write direct to:

The Education and Training Officer,
The Electricity Council,
12 Winsley Street,
London, W.1.



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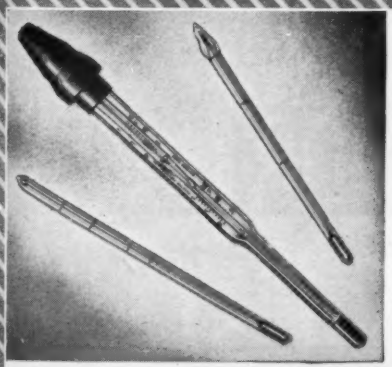

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0— 100 V.	0— 1000 V.
0— 250 V.	
0— 1000 V.	

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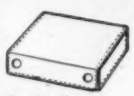

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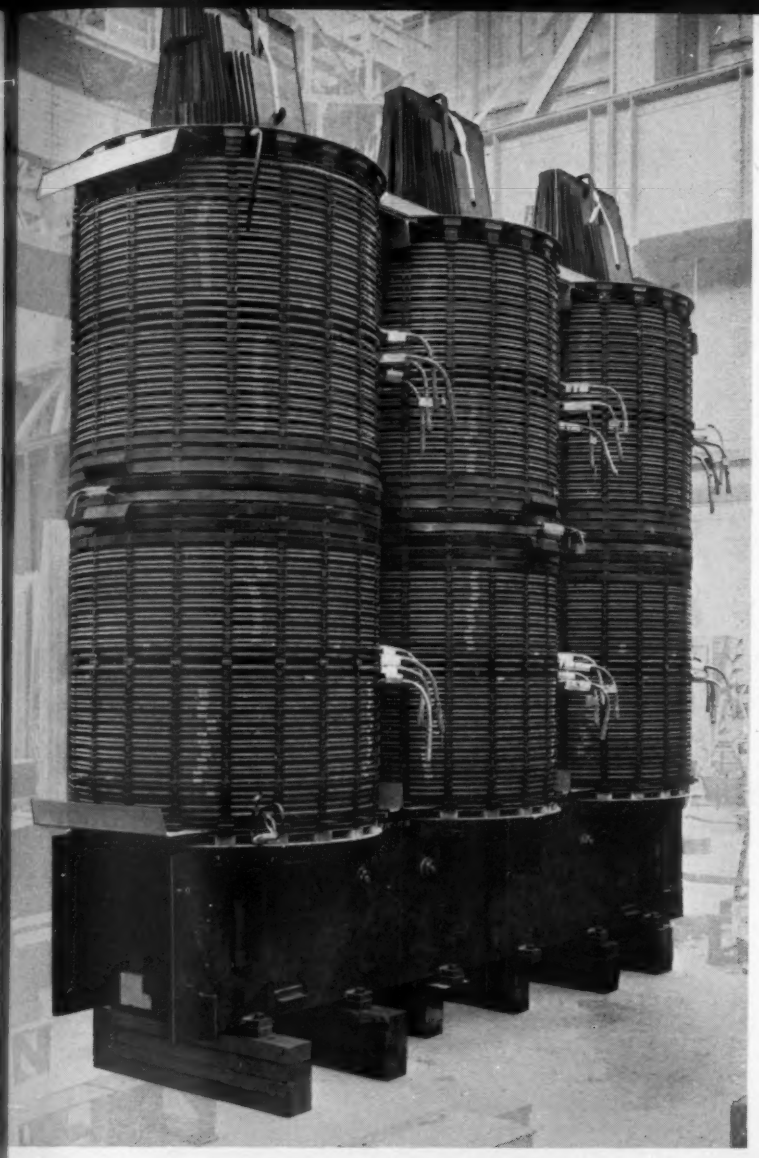

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This photograph shows the first of six 45 MVA transformers for Canada wound for a voltage ratio of 230/13·8 kV and showing the transformer during assembly after the 230 kV coil stacks have been put on the limb but before blading of the top yoke.

The 230 kV connection is at the centre of the limb so that the top and bottom halves of the windings are in parallel, the coils against the top and bottom yokes being at earth potential.

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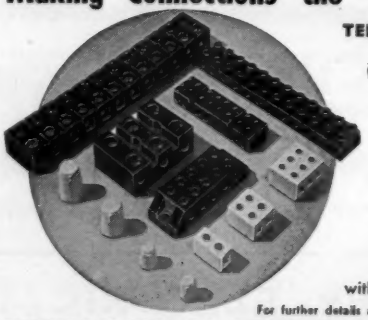

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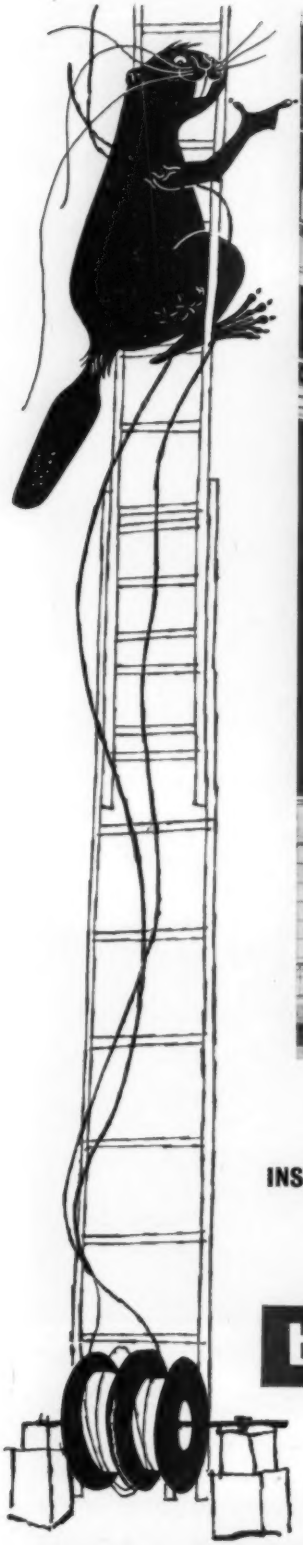

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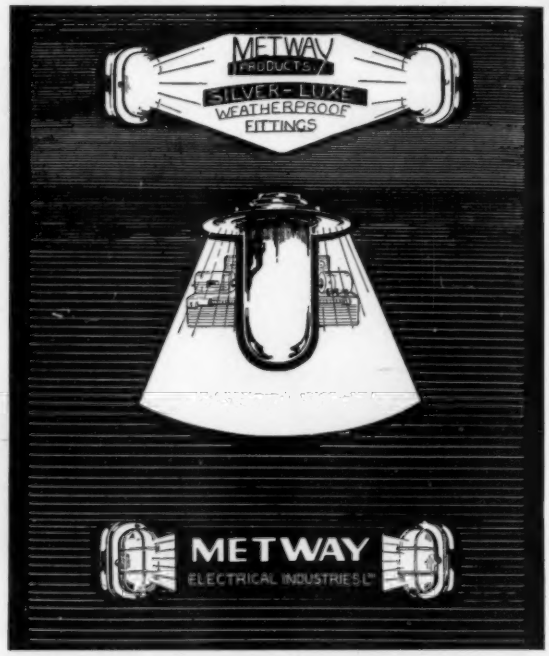

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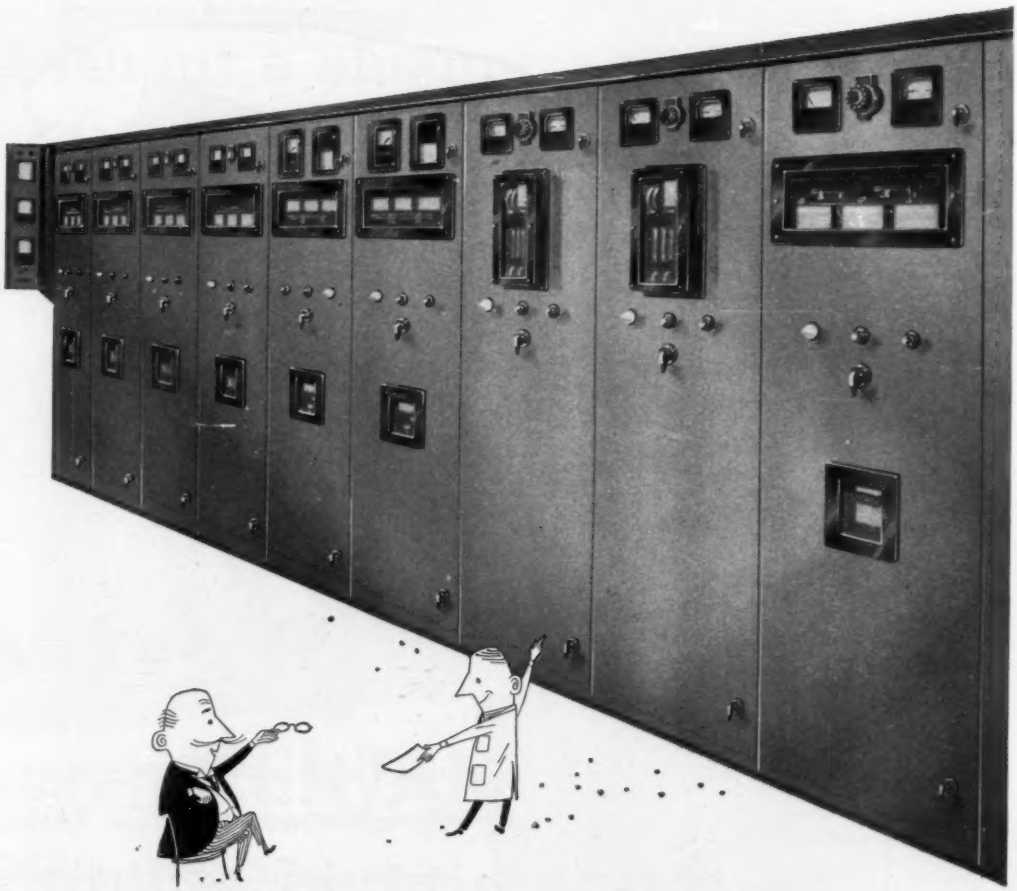

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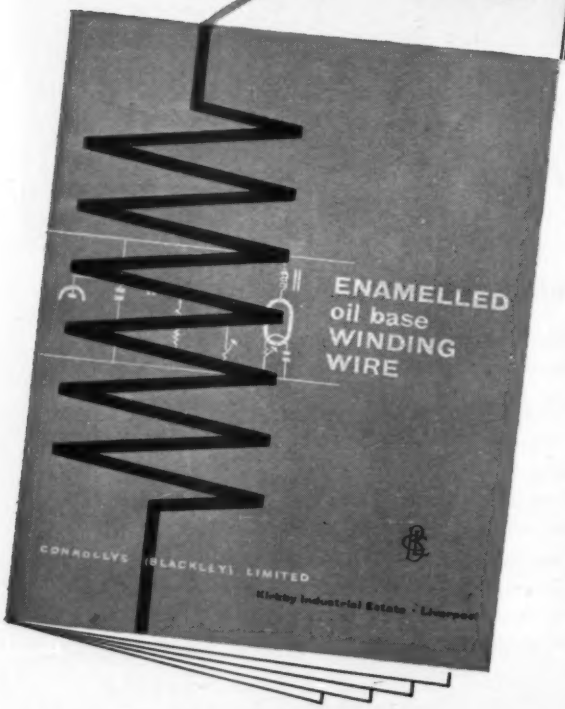

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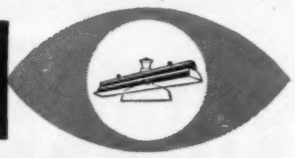

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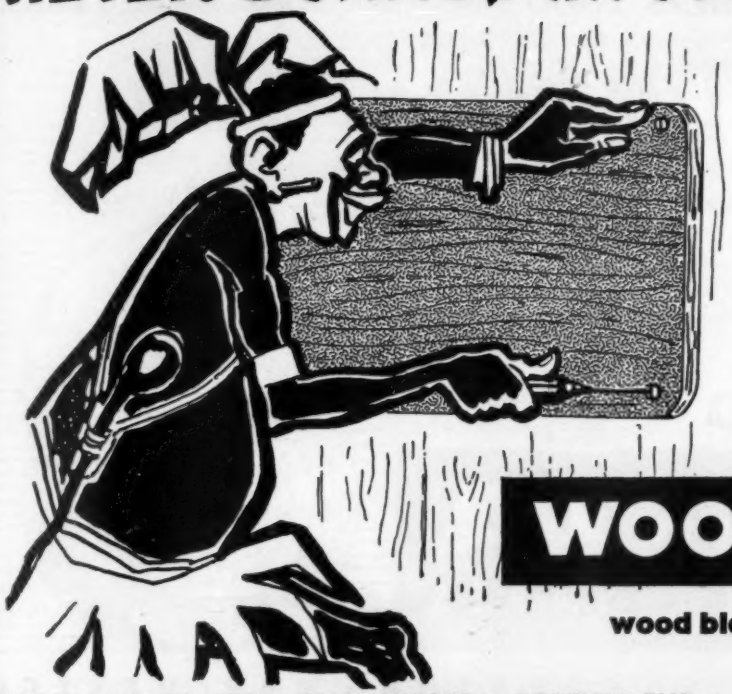

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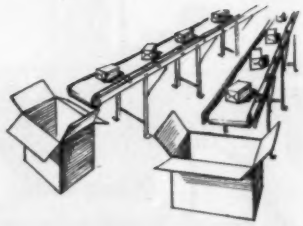

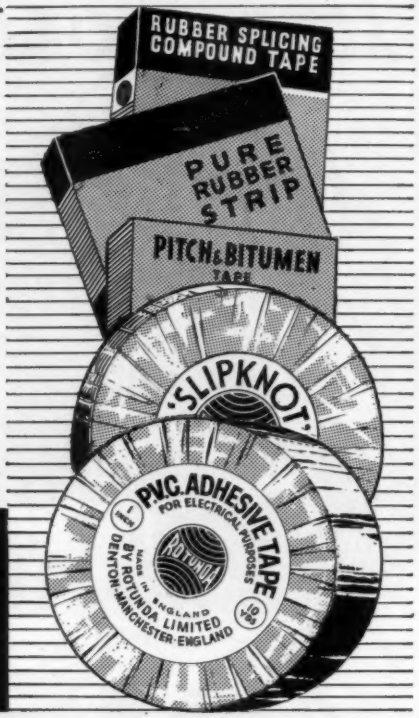

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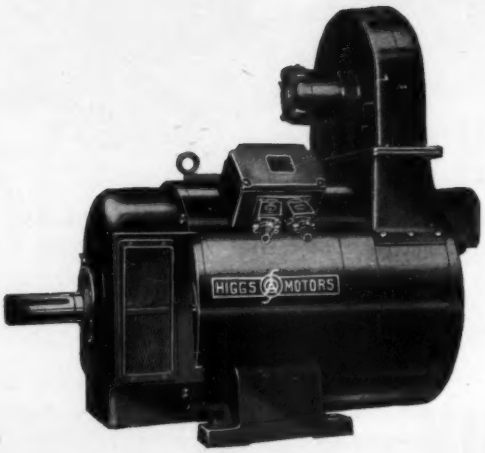

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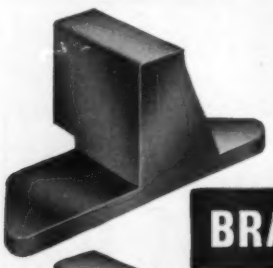

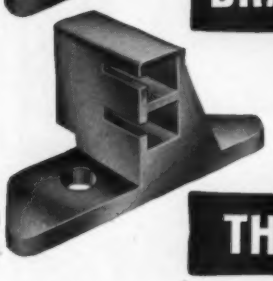

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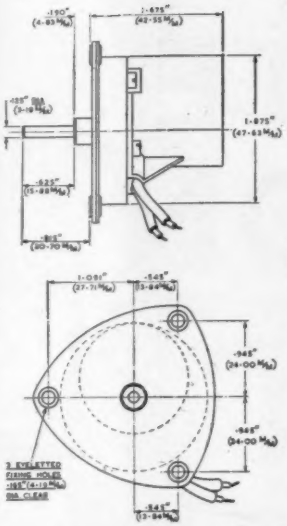

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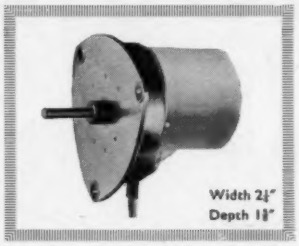

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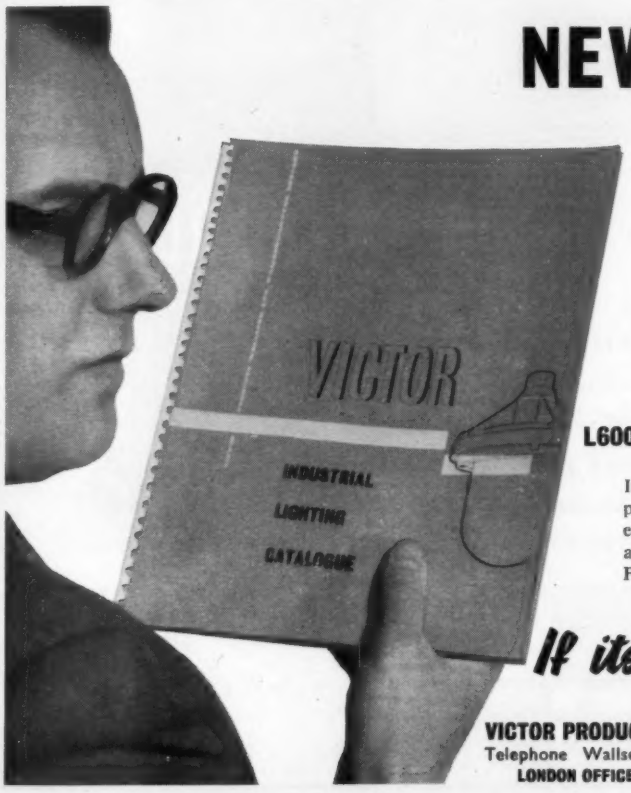

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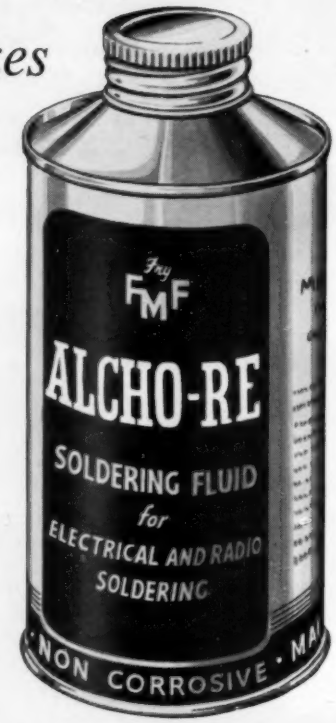

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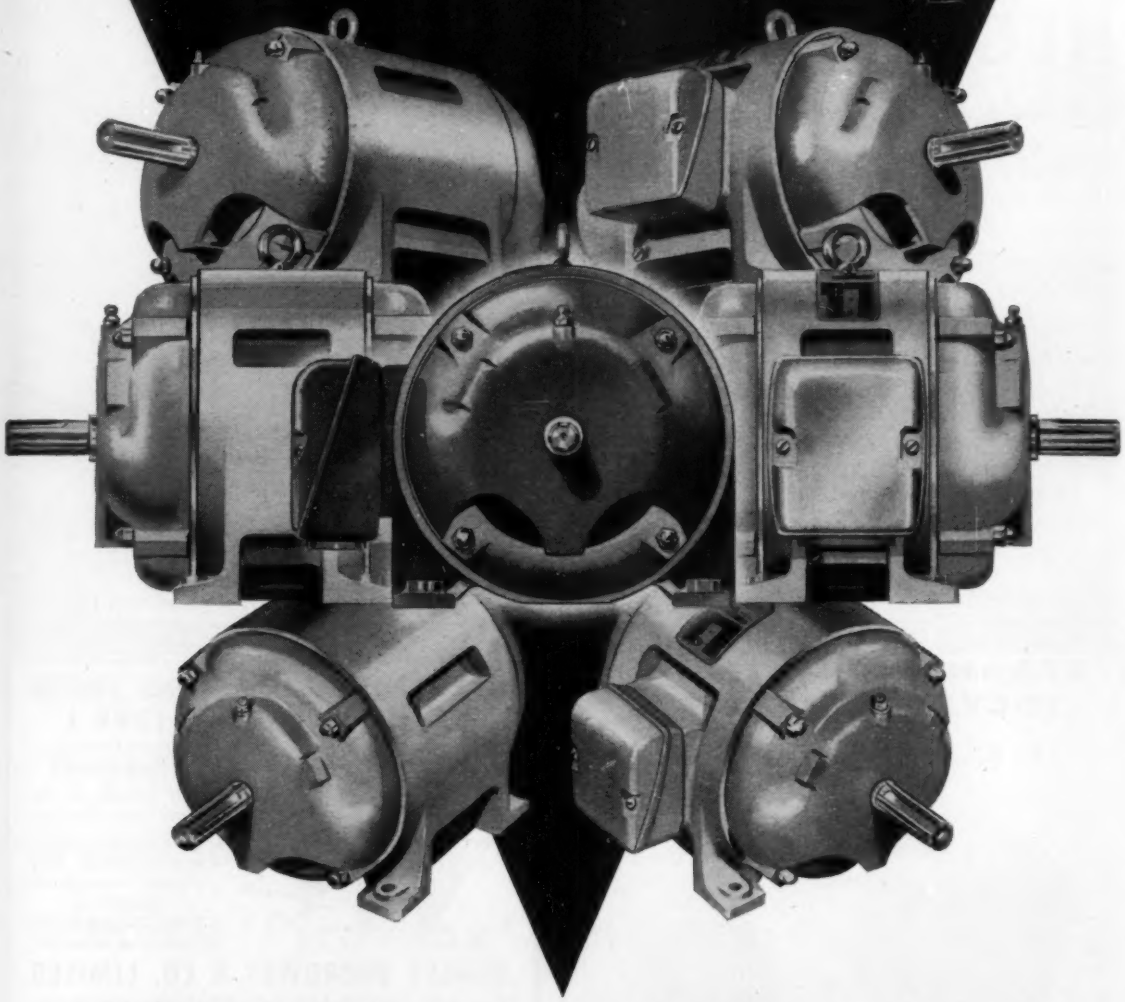

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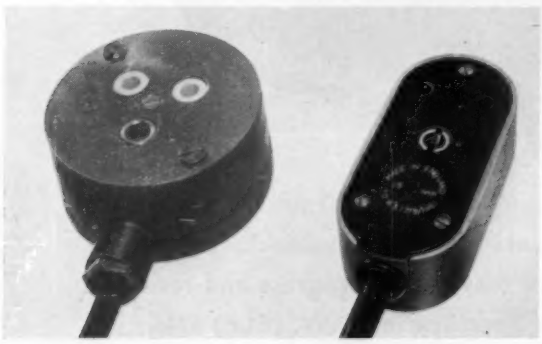

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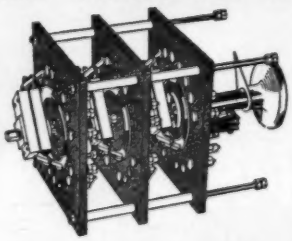

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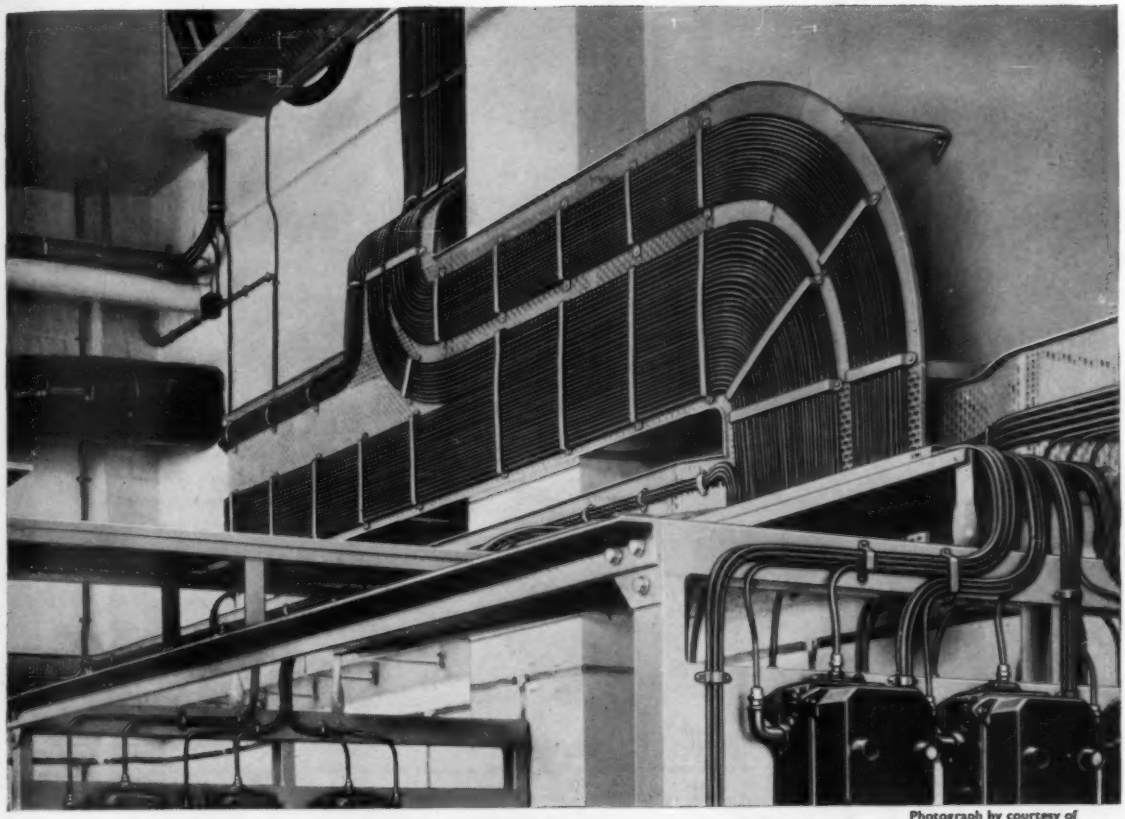

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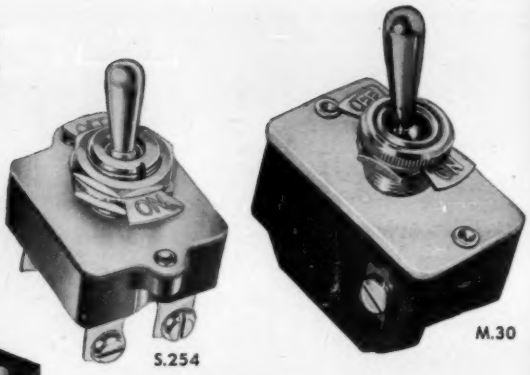
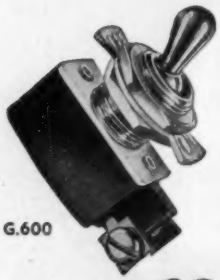
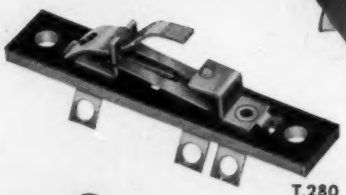


S.254 M.30



G.600



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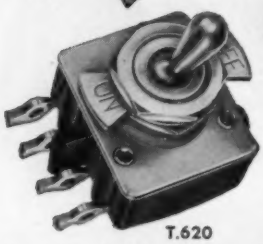

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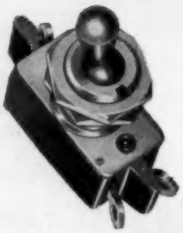

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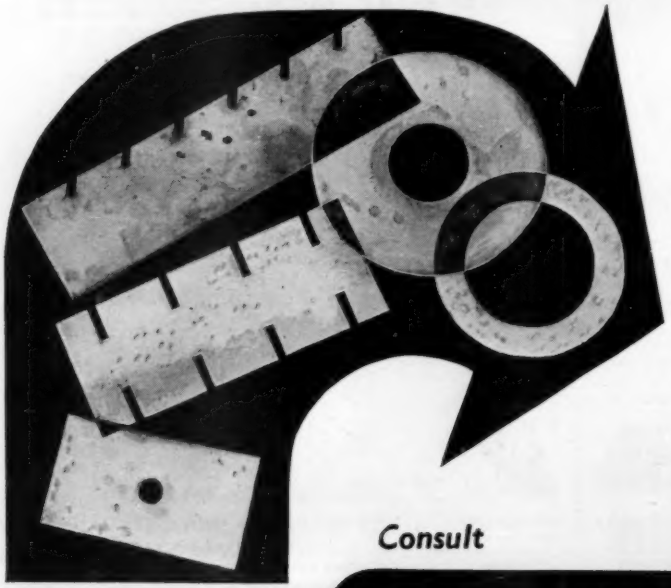

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For quick, easy, non-tensioned Tee or Service connections, BICC Overhead Line Taps are made from the minimum of components. Conductors are held parallel in a slot and locked by a clamped nut and pad—an efficient contact *which cannot be shaken loose by vibration*. The line conductor is not cut and connection can be made wherever convenient.

There are alternative taps for different types of conductor, and also to suit corrosive conditions. A separating washer is used for bi-metallic connections and bare aluminium conductors.

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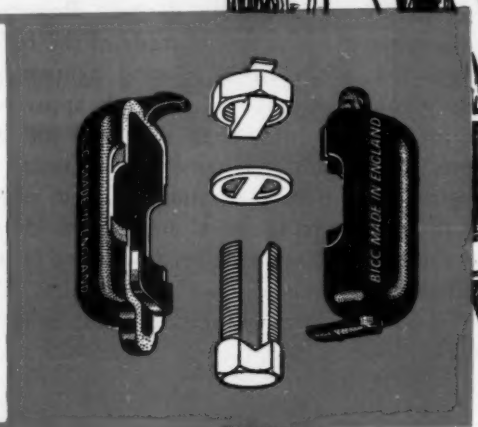
Publication No. 338 gives further information on BICC Overhead Line Taps. May we send you a copy?

BICC

overhead LINE TAPS



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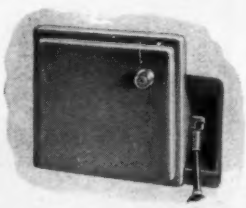

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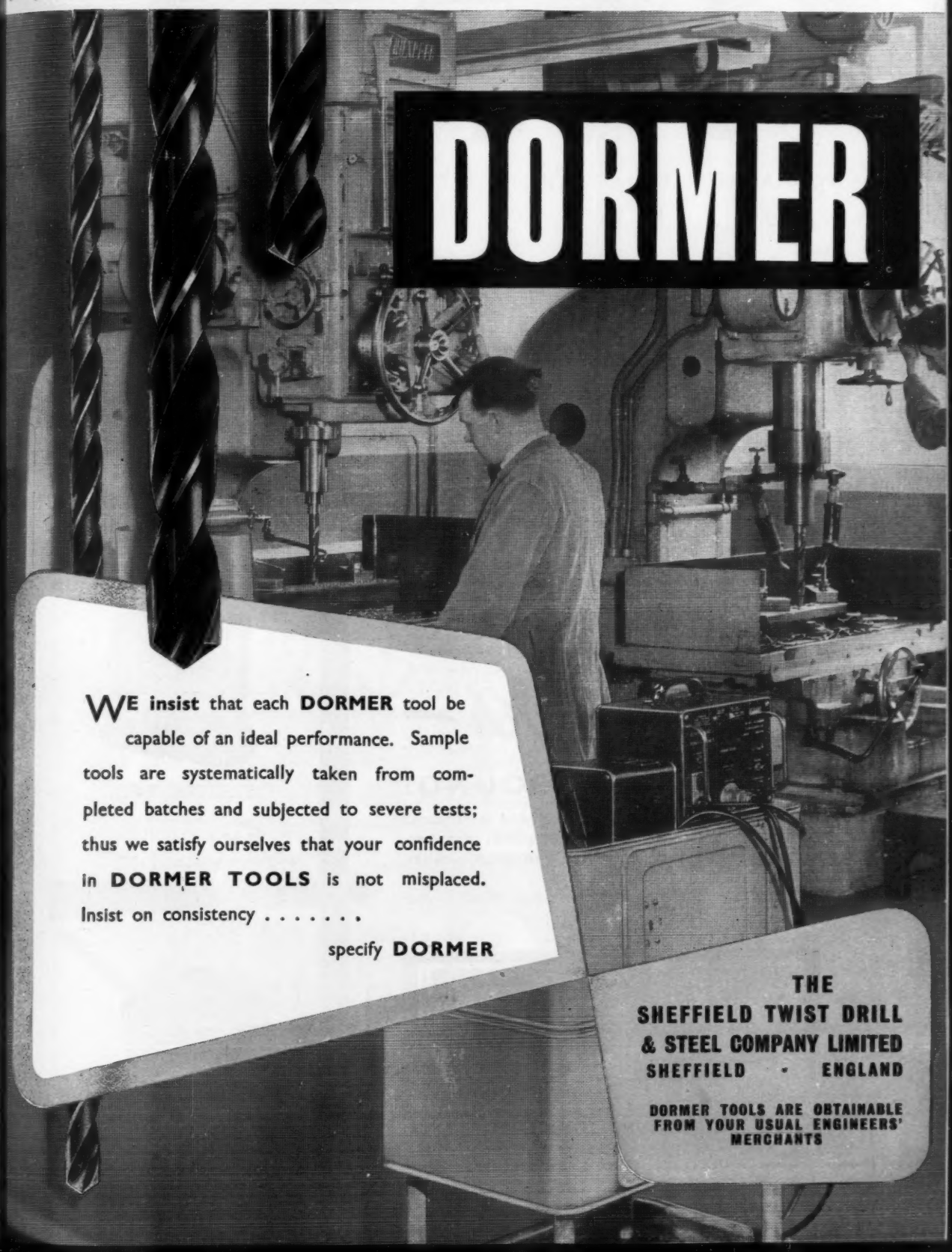

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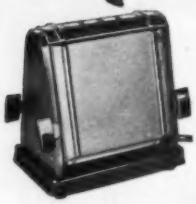
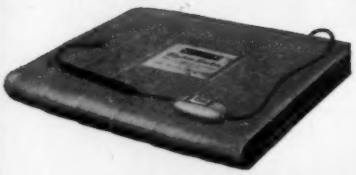


TOASTERS

WHISTLING KETTLES



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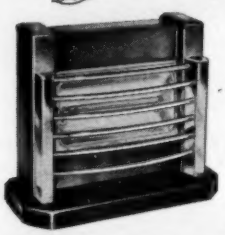
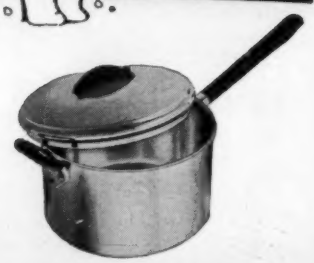


ELECTRIC FIRES



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For Electric Cookers

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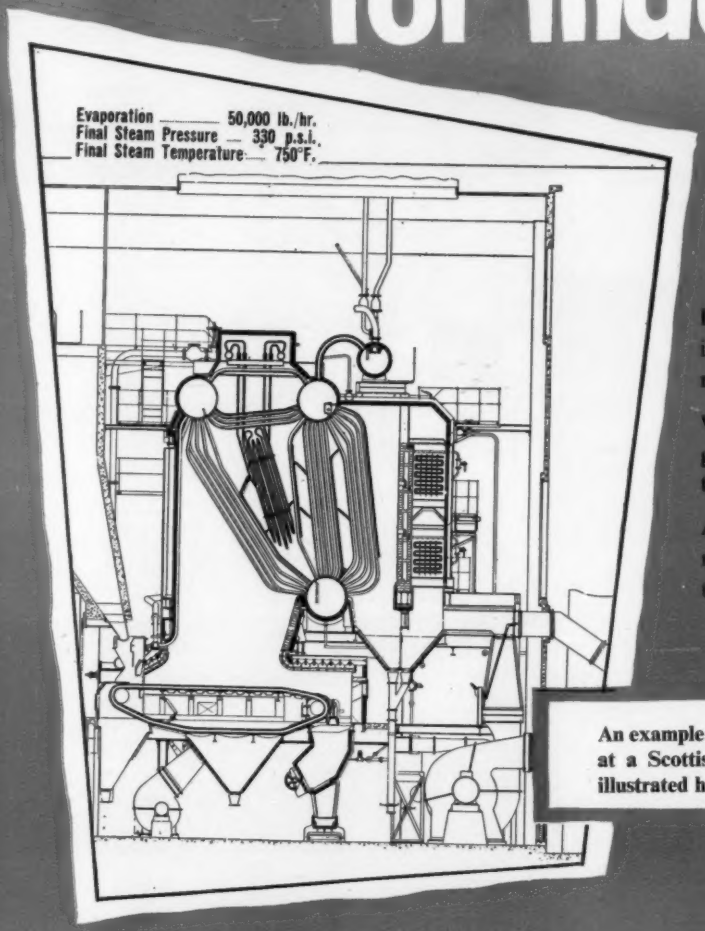
Steam raising for industry



IC build boilers to suit the individual steam raising requirements of every industry.

Whatever the problem, IC steam generating equipment ensures the best use of fuel resources.

Allied equipment covers every requirement from fuel handling to ash disposal.

An example of an installation at a Scottish Paper Mill is illustrated here.

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IC

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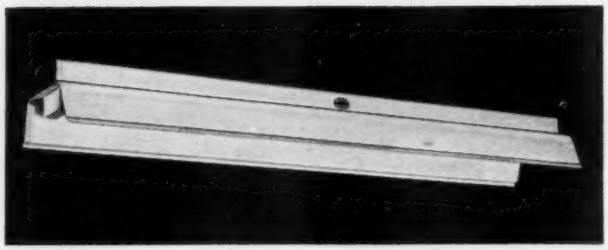
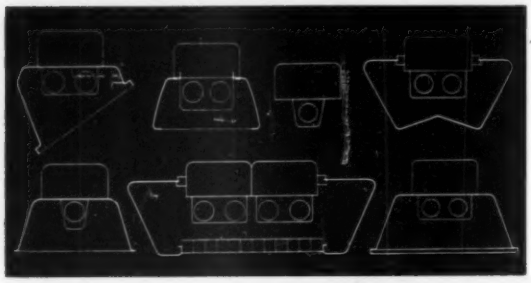
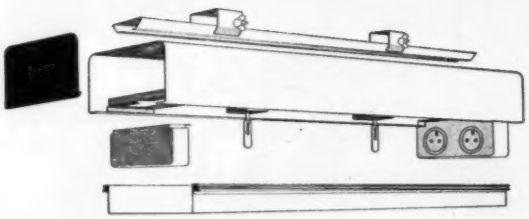
A FAMILY OF 366 FLUORESCENT FITTINGS

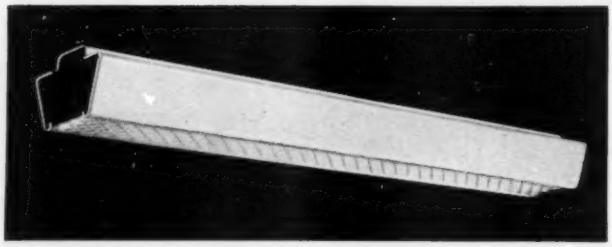
The Atlas Atlantic range provides an unfettered choice of fluorescent lighting fittings for all lighting applications—industrial, commercial or general purpose. The choice runs to type of fitting, length, number of tubes, gear, suspension, etc., yet the entire range stems from one basic chassis and a few simple attachments. This degree of standardisation, coupled with unique design features, greatly simplifies installation—particularly in coping with changes in large installations. Maintenance is easy, efficiency and quality are of a very high order and prices competitive.







Features of the Atlas Atlantic chassis include:
8ft., 5ft., 4ft. or 2ft. sizes. Single, twin or multiple tubes; bi-pin spring loaded lampholders; enclosed switch- or quick-start gear, easily detachable reflectors or diffusers; fixed or adjustable suspension.



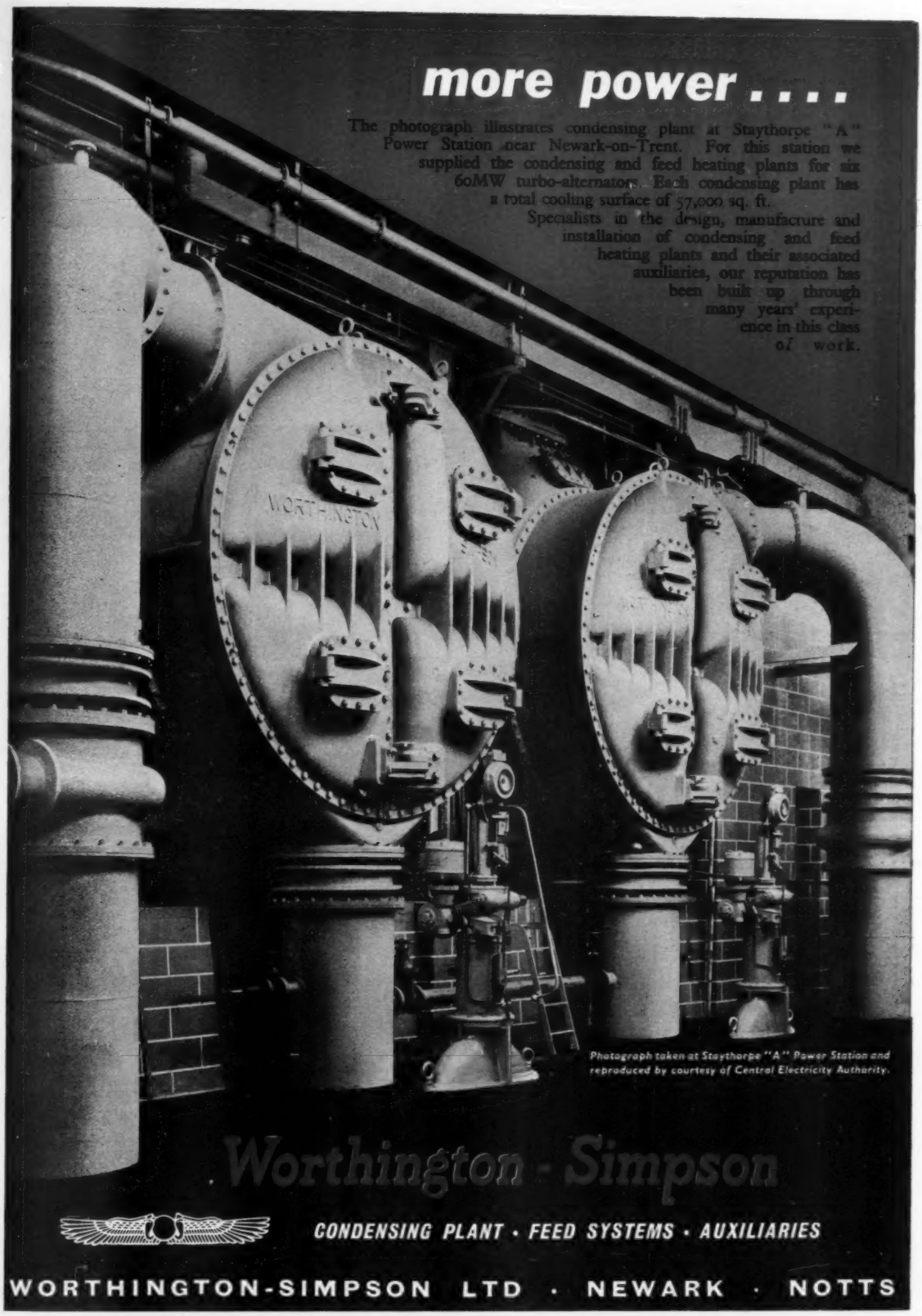
atlas atlantic

Top right. The range includes Industrial fittings with single piece open-ended slotted metal reflectors (series 10), closed end, slotted reflectors (series 103), open or closed end unslotted reflectors (series 19/193) and metal louvre attachments (series 10L and 19L). All metal work is stove enamelled white, with black ends to chassis.

Bottom right. A wide choice of decorative fittings for commercial applications is available. Series 15 (illustrated) have louvred plastic diffusers that snap into foam plastic filled channels; and are white stove enamelled with black end plates.

ATLAS leads in Lighting

ATLAS LIGHTING LIMITED *A subsidiary company of Thorn Electrical Industries Limited* 233 SHAFTESBURY AVENUE LONDON WC2


more power....
The photograph illustrates condensing plant at Staythorpe "A" Power Station near Newark-on-Trent. For this station we supplied the condensing and feed heating plants for six 60MW turbo-alternators. Each condensing plant has a total cooling surface of 57,000 sq. ft.
Specialists in the design, manufacture and installation of condensing and feed heating plants and their associated auxiliaries, our reputation has been built up through many years' experience in this class of work.
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INDUSTRIAL LIGHTING UNITS

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Where trouble is experienced on machine tools due to suds getting into the lampholder, the sudsproof head with enclosed lampholder can be used instead of the standard head.

Various lengths of arm (maximum horizontal reach 54 in.). With pillar or short vertical pivot. Six sizes of reflector. Bases for wall, bench, ceiling, floor or for mounting direct on machines. Also portable types.

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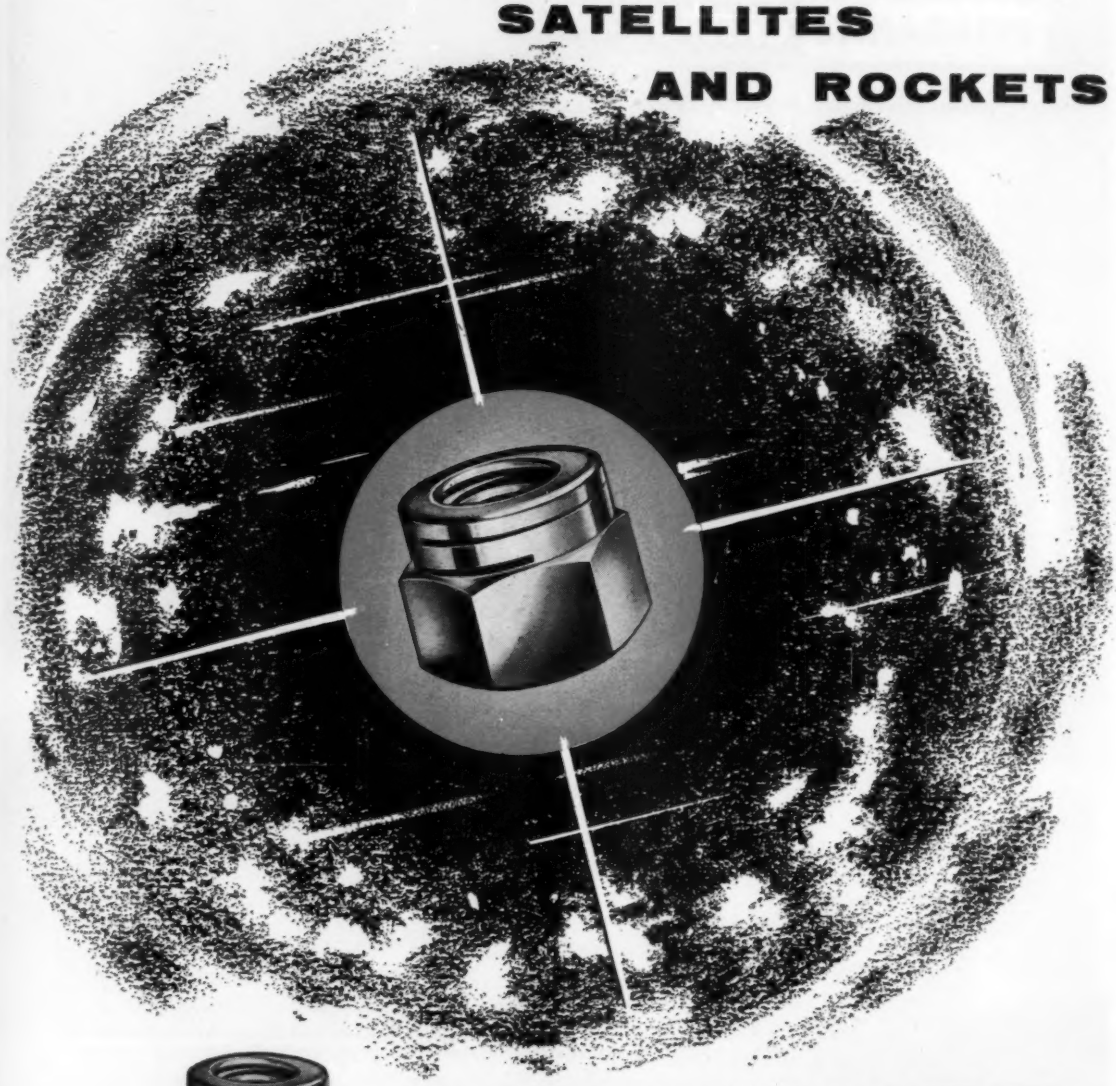
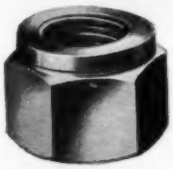


TURRET TYPE

PHILIDAS

SELF-LOCKING NUTS

WILL BE USED



INDUSTRIAL TYPE

Potential conquerors of space take no risks in fitting Philidas self-locking nuts. Their ingenious opposing torque cross-cuts feature sets up a tension that only a spanner can release. Vibration, heat changes and oil infiltration leave Philidas nuts completely unmoved—and they can be used again and again. Range includes standard and thin industrial and turret nuts, turret wheel nuts, single and double anchor nuts.

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Look at these advantages — Light as aluminium. High resistance to wear. Wide range of resistance to chemical attack. Easily machined. High thermal conductivity. Excellent heat radiation. Not wetted by molten metal or slags. Non-seizing. Self-lubricating. High resistance to thermal shock. Good mechanical strength at high temperatures. Good electrical conductivity. Available in impervious forms. Low thermal expansion.

These properties give Morganite Carbon vast potentialities for the design engineer. Talk them over with our technical staff.

The illustration shows a Rectifier Control Grid, a Rectifier Anode, a Boat, a Bearing, a Piston Ring, a Tube and a Valve Anode—just a small selection of products showing the remarkable versatility of Morganite Carbon.

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DUST-PROOF & WEATHER-PROOF REFLECTOR BOWL UNIT

A TYPICAL FRAMEPROOF UNIT

A few of the Holophane units for industrial purposes are illustrated here. Write for Cat. 5600 and see the complete range.

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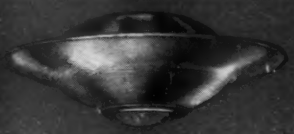
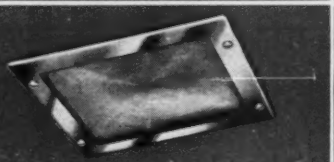
A TYPICAL STEPLITE CEILING UNIT

LUMILUX ALL-GLASS TRANSLUCENT UNIT



AURALITE UNIT WITH SMOOTH EXTERIOR GLASSWARE



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SCIENTIFIC ILLUMINATING ENGINEERS

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NEW R.D.C.* CAP

FOR

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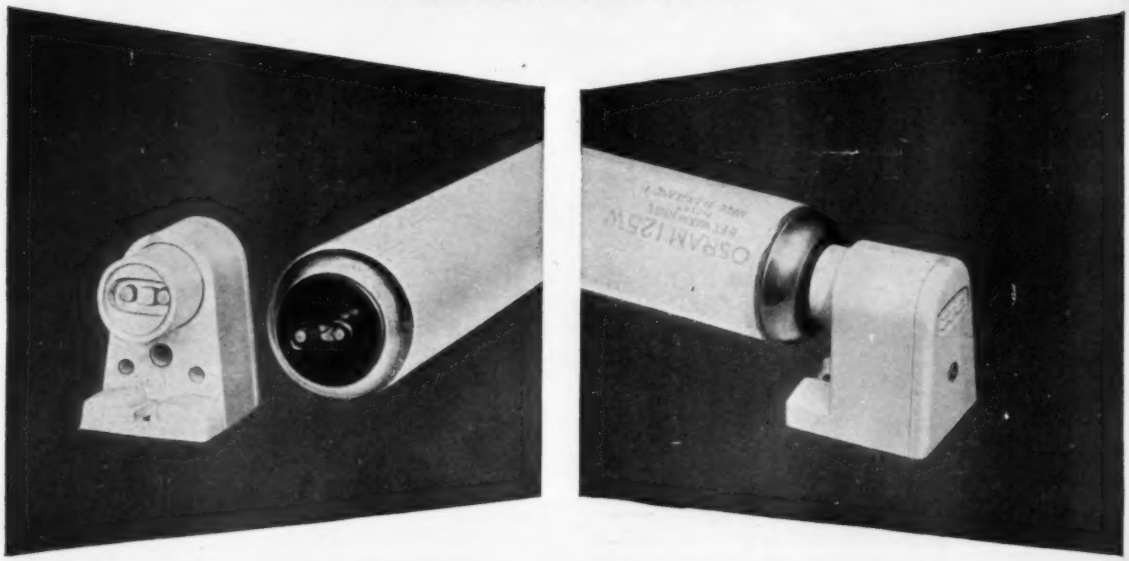
8ft. 125W. GUARANTEED TUBES

* *Recessed Double Contact*



- Robust central moulded spigot on lamp cap protects recessed contacts and gives easy location when inserting tubes.
- Tube removal or replacement can be carried out single handed from one ladder position at either end of the fitting.
- New cap design gives firm, reliable location and support for the tube without the need for independent clips.
- Electrical connections made by spring-loaded plungers in retractable holders.
- Compact cap and holder unit enables dark area to be reduced at end of fitting.

Osram *FOR PROGRESS AND SUPERB QUALITY*

For use with 8 ft. units in the new

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101 *range*

of

Fluorescent lighting fittings

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FG.3188

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The full range of Crompton Parkinson alternators extends up to 1500 kVA — and all have the benefit of manufacturing experience that goes back to the earliest days of electric power generation.

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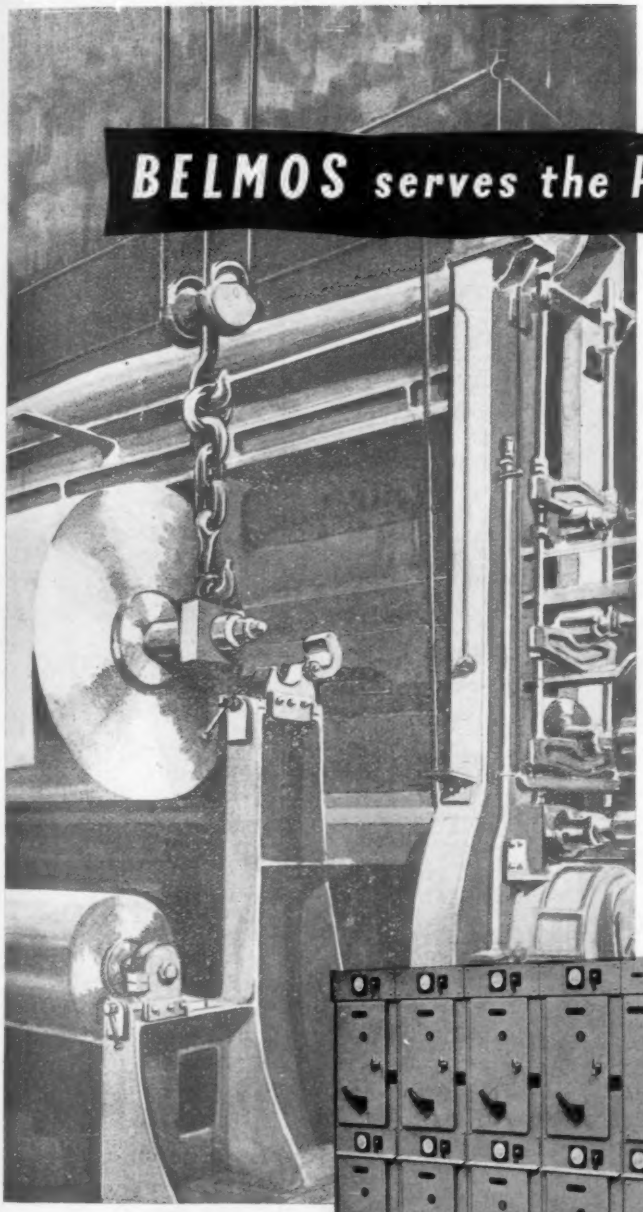

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There is little need to emphasise the part played by motor control gear in the making of paper. Belmos control gear has earned the complete confidence of plant engineer and management alike in the paper making industry throughout the world.

With over thirty years' specialist experience in the manufacture of switchgear and motor control gear, the company is justifiably proud of the part it is playing in the production of fine papers and boards.

An experienced engineering staff is available at the works and throughout the country, able to advise on the problems associated with the utilisation and application of switchgear and motor control gear.

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the **Belmos** ***company limited***

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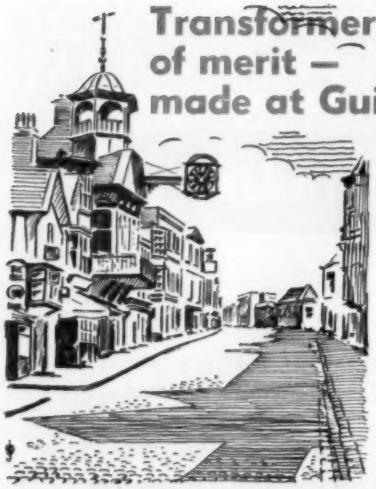

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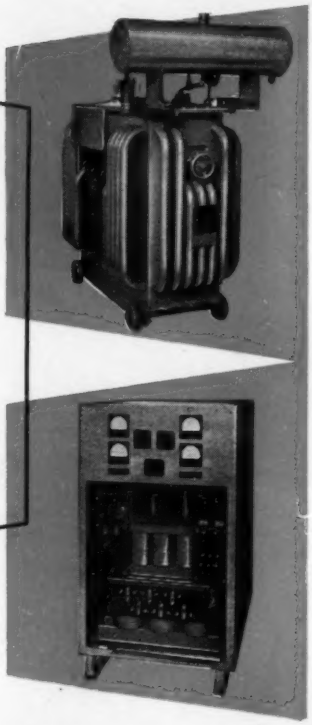

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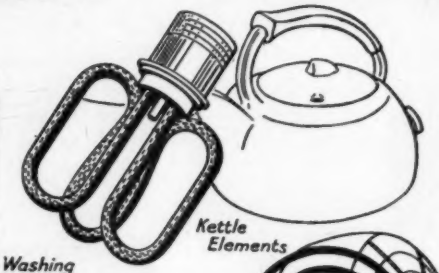
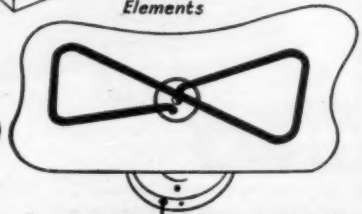


Kettle Elements

Water Heater Elements

Space Heater Elements



Space Heating Infra-red Elements

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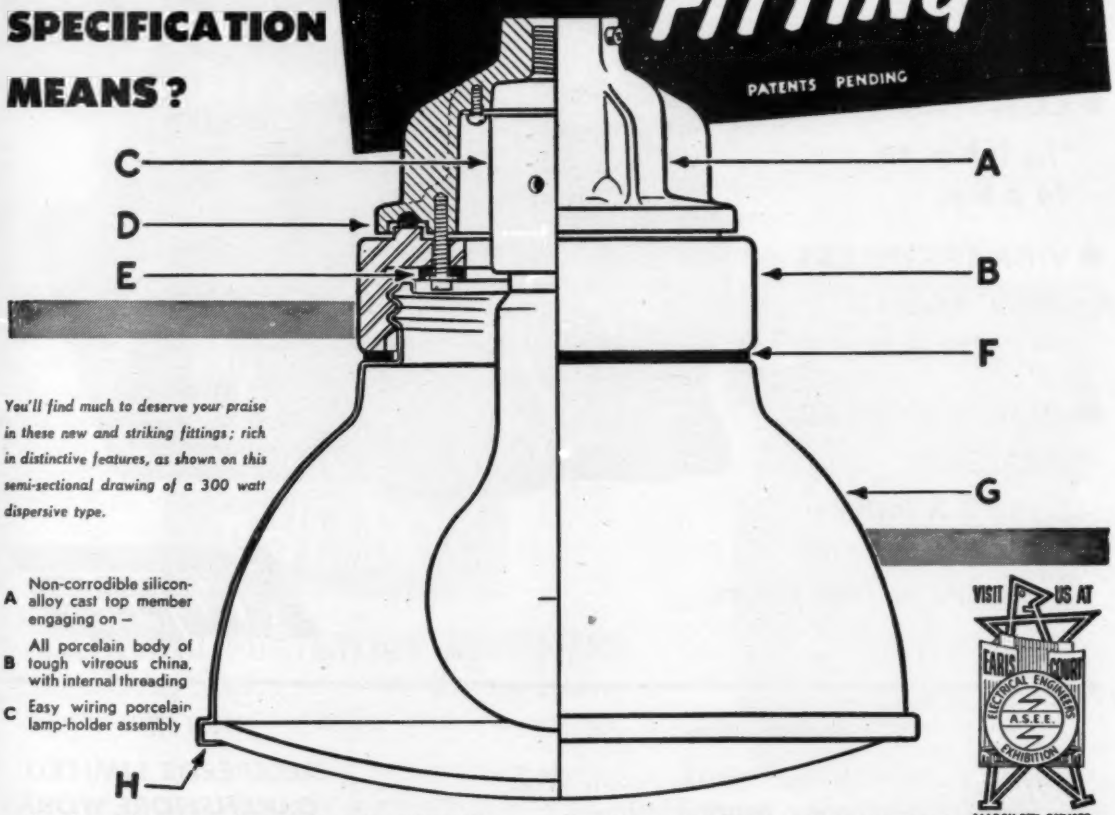
THE TETRA ENGINEERING CO. LTD
1-3 Redhill Street, London, N.W.1 Tel. EUSton 3707 PBX

It's well worth looking into!

The R.E.A.L. NON-CORRODIBLE 'REFLECTORTIGHT' FITTING

PATENTS PENDING

DO YOU REALISE WHAT THIS SPECIFICATION MEANS?



You'll find much to deserve your praise in these new and striking fittings; rich in distinctive features, as shown on this semi-sectional drawing of a 300 watt dispersive type.

A Non-corrodible silicon-alloy cast top member engaging on –

B All porcelain body of tough vitreous china, with internal threading

C Easy wiring porcelain lamp-holder assembly

D Gastight and dust-tight joint between top member and porcelain body.

E Silicon-alloy supporting ring reinforcing 3-point fixing of porcelain body to top member.

F Bonded cork gasket providing positive joint between porcelain body and –

G Screw neck reflector of heavy gauge aluminium, specially treated.

H Heavy section pressed heat-resisting glass dome, permanently sealed in position at mouth of reflector.

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THE PRESENT RANGE OF FOUR PATTERNS

List No.	Description	Lamp Size
1090	Dispersive 10" dia.	100 watt
1093	Concentrating 8" dia.	100 watt
2000	Dispersive 12" dia.	200 watt
2010	Dispersive 12" dia.	300 watt

Publication No. P5601 gives full details of this new range

Issued by ROWLANDS ELECTRICAL ACCESSORIES LTD., R.E.A.L. WORKS, BIRMINGHAM 18

C

A GEARLESS GEARBOX

- STEPLESS SPEED VARIATION
- FINGER TIP CONTROL
- CONSTANT H.P. 1/33 b.h.p. to 14 b.h.p.
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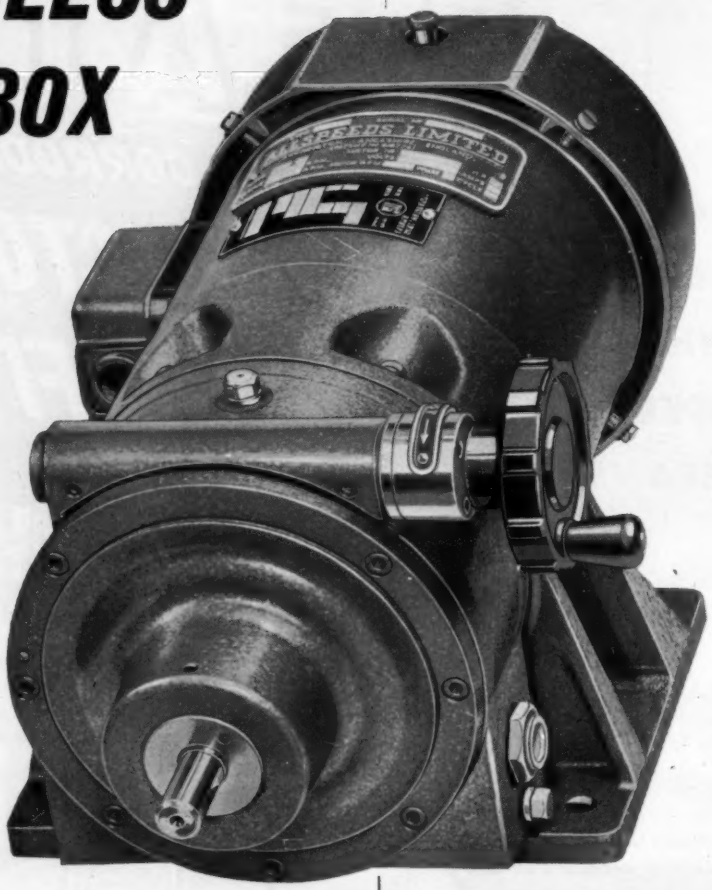

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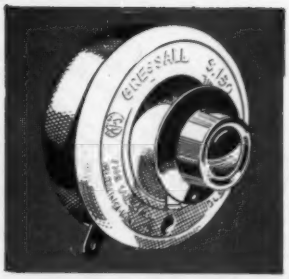

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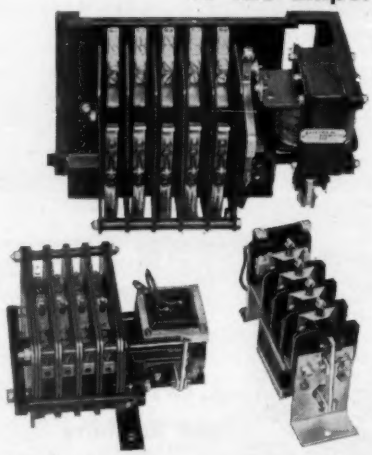

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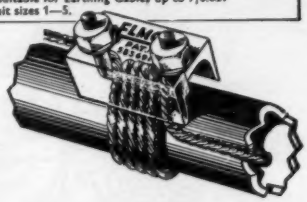

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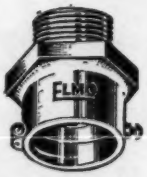

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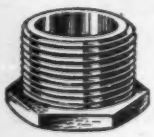

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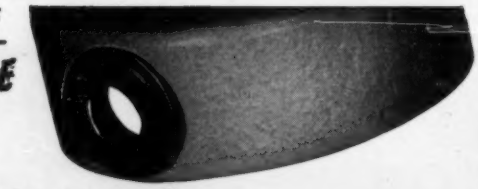

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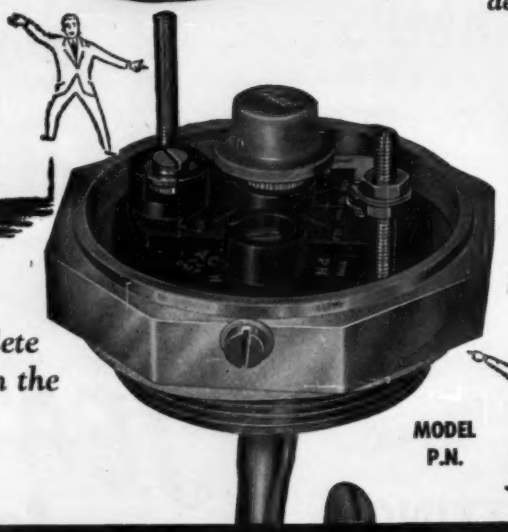

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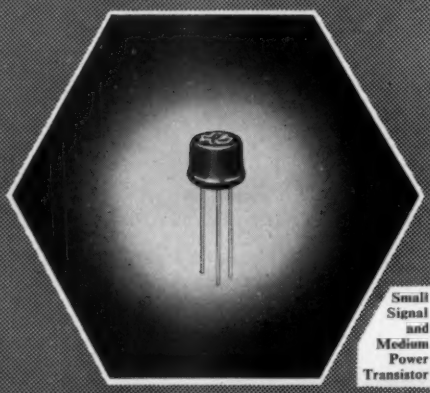

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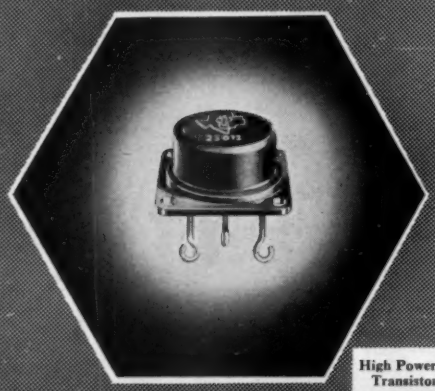
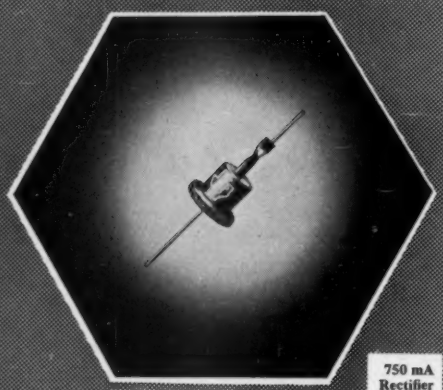


High Power Transistor



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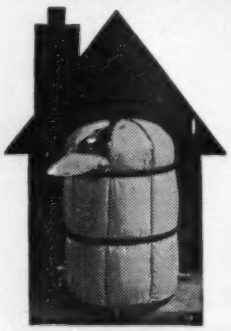

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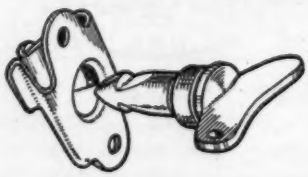

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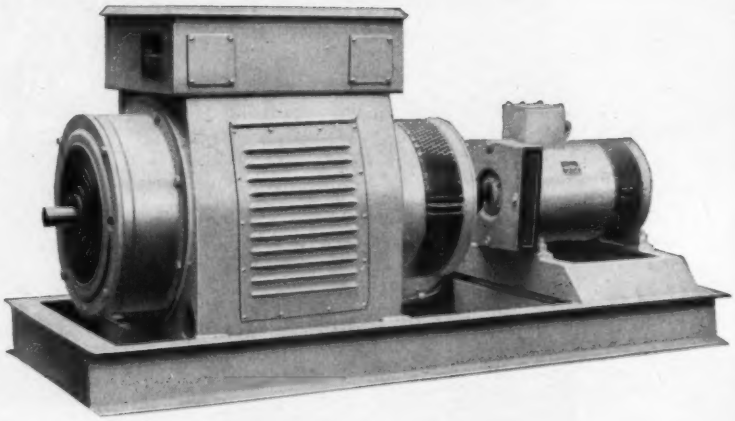

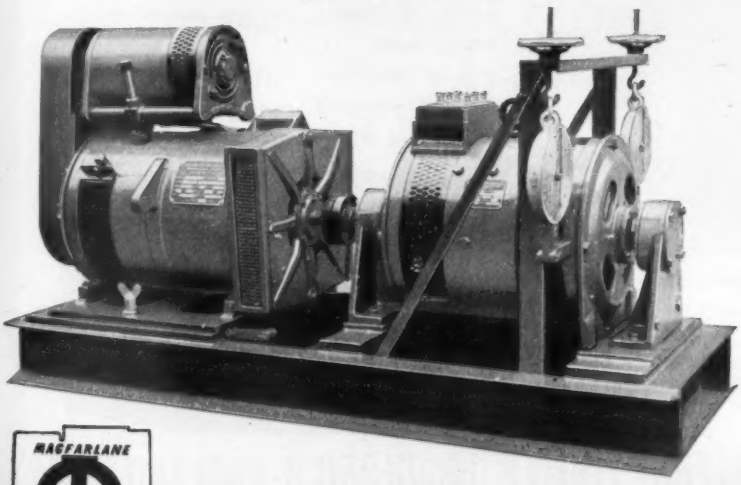

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14 FEBRUARY
1958

ELECTRICAL REVIEW

Managing Editor: HUGH S. POCOCK, M.I.E.E. *General Editor:* J. H. COSENS *Technical Editor:* P. W. TUCKER, M.I.E.E.

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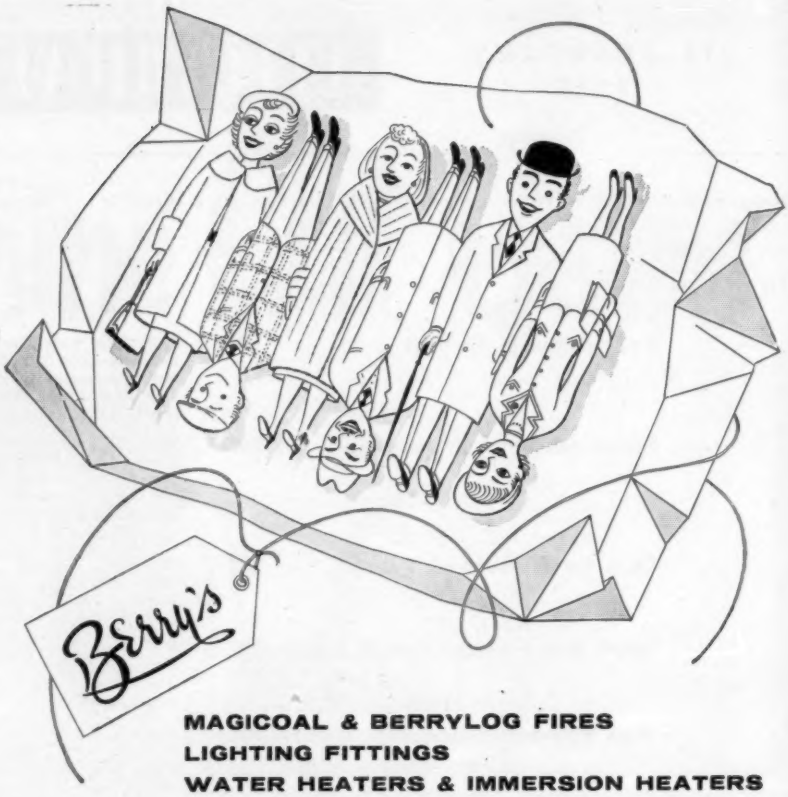
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ELECTRICAL REVIEW

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Apprenticeship Conflict

In 1950 a national apprenticeship agreement was introduced to deal with the conditions of employment and the education of boys entering the electrical contracting industry. The Ministry of Works took a hand in this by providing secretarial services in connection with a registration scheme administered by an Apprenticeship and Training Council. Both the National Federated Electrical Association and the Electrical Trades Union contributed to the cost of the scheme.

Last November the Ministry of Works, after ample notice, withdrew the registration scheme and ceased to provide secretarial services. The N.F.E.A. considered that registration in itself served no useful purpose but it wished the Apprenticeship and Training Council to continue. It held the view that many of the boys who were registered failed to benefit from the technical education for which their employers released them during working hours. Accordingly it suggested that there should be a distinction between craft apprentices and technical apprentices, to be made upon the results of the preliminary examination for " Course B " of the City & Guilds of London Institute. Those who failed to pass would be classed as craft apprentices, with no day-release facilities, while the successful ones, the technical apprentices, would continue to enjoy these facilities (up to the age of 19) and be given additional wages during their apprenticeship. Afterwards both classes would receive the same pay, although employers would have (as at present) discretion to reward merit.

Objection was taken to these proposals by the E.T.U. and in the January issue of its journal, *Electron*, a great deal of space is devoted to the vilification of the employers. In the Union's view registration is essential and it objects to any distinction between the bright and not-so-bright boys. It accuses the N.F.E.A. of wanting to see " a few highly skilled apprentices in the industry and a large reservoir of casual boys who can be moved about or sacked according to the needs of employers at any given time." In support of its claim that the apprenticeship scheme has " worked fairly well " it says that in the seven years of operation 13,703 apprentices have been registered and 2,886 completion certificates issued.

The Union refers to alternative schemes put forward by the chairman of the Apprenticeship and Training Council (Sir George Gater) which would have retained registration but, it says, these were rejected by the N.F.E.A. It has instructed its members to refuse to work with any apprentice who is not registered under the provisions of the 1950 scheme or an apprentice entering after 30th November, 1957, " under a properly agreed indenture," providing for adequate training facilities.

It would seem from the figures given by the E.T.U., quoted above, that about 20 per cent of the registered apprentices received completion certificates, a fact

which seems to support the N.F.E.A.'s argument that a high proportion of boys have failed to benefit from technical education. Why should the Union object to a distinction being made between capable and less-capable apprentices? Surely the aim of both parties should be to maintain a high standard of workmanship, which in the case of electrical installation work involves much technical knowledge. For our part we would like to see merit rewarded, not at the discretion of the employer, but on a firmer basis.

ENGINEERS AND CHEMISTS

In his Kelvin Lecture at the Institution of Electrical Engineers last week, which is reported on another page, Dr. H. W. Melville referred to a real possibility of high-polymer chemists producing "man-made" materials for use by electrical engineers. About twenty years ago the view was sometimes expressed by cable makers and others concerned with insulation that acceptance of what nature provided was a handicap to development. Difficulties were growing with increasing voltages and diversity of uses. While these have been progressively overcome, reliance on natural products has resulted in some waste. The need to meet a leading technical requirement has often automatically entailed the reaching of the same high standard by unwanted natural properties, thus adding to bulk and weight and hence cost. It seems that the time is approaching when electrical engineers will be able to tell chemists exactly what conditions have to be met and leave it to them to devise what may be necessary.

NATIONAL BOARDS' FINANCE

Changes in the methods of providing capital for the electricity industry, along with all the other nationalised industries except the coal industry, are apparently being considered by the Government. This is indicated in a reply given by Mr. R. Maudling, Paymaster General, to Col. Lancaster, who is chairman of the Conservative back-benchers' Fuel and Power Committee.

For several years there has been strong back-bench pressure on the Government to end the system whereby the nationalised industries can raise money under a Treasury guarantee on the national credit through the gilt-edged market. Many Conservatives have argued that the nationalised industries should compete for capital on the money market on equal terms with the rest of industry.

On the Report Stage of the Electricity Bill a Government amendment was inserted empowering both the Electricity Council and the Area Boards to make issues of stock on the market, subject to the consent of the Minister of Power and the approval of the Treasury. This was a natural implementation of the Herbert Committee's statement that the electrical industry should be conducted as a commercial concern, should be self-supporting, and (except with regard to compensation stock) should be able to finance itself without any reliance upon a Treasury guarantee.

Under the Finance Bill, 1956, provision was made for advances to be made from the Treasury to a total of £700 million to the nationalised industries, apart from the National Coal Board, up to 31st March next. Mr. Maudling told Col. Lancaster that the Government intended to extend this arrangement to the end of August and to consider within this period the future method of financing these industries.

The annual dinner of the Institution of Electrical Engineers is to take place on 27th February. In advance of the event we are publishing next week a specially-commissioned portrait of the President of the Institution Mr. T. E. Goldup

WHAT LORD MILLS REALLY SAID

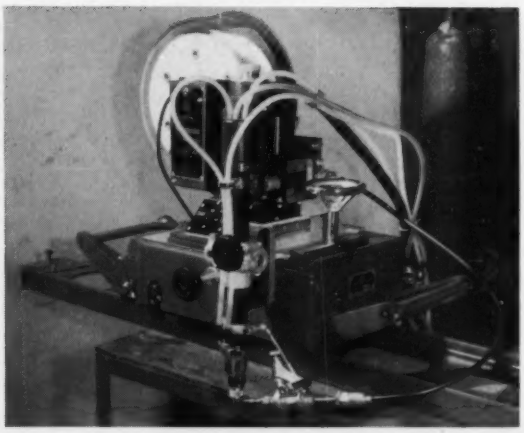
Last week's debate in the House of Lords on fuel and power resources turned largely on the question of coal economy, although the quite distinct question of competition between the electricity and gas industries was raised. Reports of the reply by Lord Mills, Minister of Power, have given an impression that he was embarking upon the "co-ordination" of the two industries but really all that he said was that critics felt that there was an avoidable duplication in the "distribution services" of gas and electricity. He instanced the duplication of showrooms, and said that he had decided to set up a committee to consider ways of improving co-operation between the Electricity and Gas Boards in the performance of their statutory functions and in the administration of the services of a like kind provided by the two industries.

There were, he said, many things which determined the pattern of fuel use—technical considerations, consumers' preferences and the question of price. He had seen no overwhelming proof that present competition led to a waste of resources. "Even if waste could be found, there certainly would be no grounds for believing that it would be greater than that which I am sure would ensue if a body of officials tried to settle what fuel was good for people to use." We applaud these sentiments which we are convinced are well-based.

CO-ORDINATION IN NEW ZEALAND

As a footnote to Lord Mills' statement and recent comments we have made on the subject it is appropriate to refer to what is being done in New Zealand. In 1956 the Government of that country passed the Electricity and Gas Co-ordination Act providing for the merging of electricity and gas undertakings in New Zealand. The subject is mentioned in the latest report of the Christchurch Electricity Committee in which it is said that it is apparently the Government's desire to withdraw the subsidy which keeps the gas industry solvent, leaving electricity supply to earn enough not only to pay its own way but also to bear the gas industry's losses.

This proposal, of course, is not thought much of by the electricity authorities and certainly such action would be just as unwelcome here. We cannot be persuaded that, for "national" reasons, electricity consumers should pay for gas (or coal) that they have not had.



Automatic argon-arc welding machine with automatic filler rod device

REVIEW OF MODERN TECHNIQUES

Fusion Welding of Aluminium

By N. T. BURGESS, A.I.M., A.M.Inst.W.*

IN any industry welding plays an important part and the ease with which any metal can be handled and joined determines its ultimate value to the engineer. In recent years the increased use of aluminium and its alloys in many industries has focused much attention on methods of fabricating the metal and, in particular, on methods of jointing it. Aluminium is now used extensively in the chemical and petrochemical industries, in shipbuilding, structural engineering, architecture and general engineering, in addition to the commonly known uses in aircraft and domestic fields.

There is a tendency for welding to replace riveting where soundness of joint, structural performance and economics are of prime consideration. This trend has been particularly apparent in the shipyard fabrication of aluminium deck houses and superstructures, and there is a tendency to use welding in structures generally where riveting would formerly have been considered. In the chemical field, welding is the only jointing method of wide application.

Until the immediate post-war years, the only processes that had been generally available for the welding of aluminium were gas, i.e. oxy-acetylene welding and, to a limited extent, metal-arc welding, using a flux-coated electrode. Despite the advent of modern electric welding techniques, it is well to bear in mind that these two original processes still have their field of application; gas welding techniques are still employed to a very large extent in the construction of chemical vessels, and metal-arc welding for the repair of castings and in certain civil engineering equipment.

Conventional metal-arc welding techniques are similar to those for steel, flux-coated electrodes being used. Efficient flux removal may prove tedious and costly and this, together with the risk of flux entrapment in some types of joint, has tended to limit the use of this process. The weldability of the aluminium-magnesium alloys by this process is not good.

* The Aluminium Development Association.

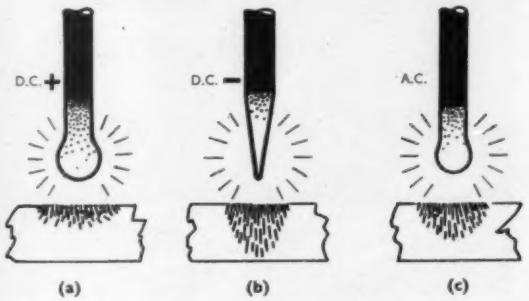


Fig. 1.—Effect of different types of welding arc, indicating the tip formation and the extent of penetration

Tungsten-Argon-Arc Welding

The most popular general welding process for aluminium in use to-day is tungsten-argon-arc. As its name implies, a shield of the inert gas argon is used with an electrode of tungsten which is not consumed in the process. The arc is struck between this electrode and the work, the tenacious oxide film that is always present on aluminium being removed by the upward emission of positive ions to the tungsten electrode, and prevented from reforming by the presence of the argon shroud which excludes oxygen from the immediate weld area and the solidifying metal. The process is suitable for welding in all thicknesses but is generally used for welding up to ¼in; above this it may be more economical to consider a further process, which will be discussed later. The welding heat is restricted to the area of the weld and therefore distortion is less than with gas welding. The various types of equipment available are suitable for use at operating currents as low as 30 A and as high as 600 A and a range of torch sizes and electrodes are used.

Basically the arc can be electrode positive d.c., electrode negative d.c., or a.c. However, when the process became used in industry, it was soon found that the heat supply from the two former arcs (although still used in specific applications) had disadvantages, and the a.c. arc is now most widely used for the welding of aluminium. The a.c. arc combines the advantages of good oxide removal during the positive half-cycle with the cool running of the electrode in the negative half-cycle (Fig. 1).

More elaborate power circuits are required than for

normal metal-arc welding and devices to start and maintain the arc are necessary. To overcome the difficulties of arc re-ignition with normal voltage transformers (80-100 V open circuit) high-frequency ionisers, which can be cut out after the arc is established, are often used. An alternative method uses the surge injection principle developed by the Electrical Research Association, but now provided in the equipment of two manufacturers. This provides a momentary introduction into the arc of a d.c. pulse, timed to coincide with the beginning of the oxide-scavenging, positive half-cycle only. This permits a lower open circuit voltage, less current from the mains, and safer welding. It also affords easier starting, less radio interference and arc stability.

The welding torch incorporates a gas nozzle which can be of ceramic material, but at high current levels these prove unsatisfactory because the rapid heating and cooling causes them to corrode. Water-cooled metal nozzles are therefore preferable for all work over 100 A.

In the initial stages of development of the process, many aspects gave cause for initial consternation; however, in recent years nearly all of these have been overcome with the result that use of this equipment generally implies extremely sound welds, made in the minimum of time at low cost. It is interesting to note that the wide acceptance of argon-arc welding has reached such proportions that a British Standard Specification is being issued on this important subject to assist in its correct use.

Cleanliness and Soundness

Soundness of an aluminium weld is a function of weld cleanliness, that is to say freedom from porosity, oxide film and inclusions, etc. Porosity and oxide film are largely functions of the efficient working of the equipment and the presence of an efficient inert gas shield, in this case argon. The quality of the shielding gas is therefore

Fig. 2.—Fully automatic welding of an aluminium milkchurn. Controlled high speed argon-arc welding in this case removed the tendency to weld cracking and produced a good clean weld without the addition of filler rod at a very economical rate

of considerable importance and it was quickly found that argon gas of 99·8 per cent purity was required for quality welding, and the major suppliers now supply a special "welding grade" of argon. (In the United States and other countries the inert gas helium is used for this process because it is cheaper and more readily available.) If the efficiency of the gas shield is poor, oxide film may remain in the weld area and become trapped in the weld. This can be considered a serious defect and should therefore be avoided wherever possible. It produces discontinuities, notches and crack initiation. This type of defect is easy to detect by non-destructive methods, and radiography, which is widely used in the inspection of aluminium welds, will indicate the presence of oxide film as a dark line. One aspect of tungsten-arc welding that can give rise to trouble is the presence in the weld of tungsten inclusions. These inclusions are also relatively easy to detect by non-destructive methods and on a radiograph the tungsten inclusion shows up distinctly as a white spot. Tungsten inclusions in the weld can arise in two ways. Firstly, the carelessness of the welder can result in "touching down" of the tungsten electrode into the weld pool and this inevitably results in a part of the tungsten leaving the electrode and embedding itself in the molten metal. Such inclusions can be quite large and the weld is unacceptable for many purposes. The presence of fine and dispersed particles of tungsten in the weld are more common and in this case are due to dissociation of the tungsten electrode. Breakdown is invariably due to the electrode becoming overheated as a result of operating for too long a period, or at too high a current. For this reason the correct size of electrode should be selected with due regard to the duty cycle and to the operating current. In recent years alloys of tungsten have been suggested for these applications and these are commonly known as activated tungsten electrodes, the two most popular being "thoriated" and "zirconiated." The additions are intended to make the electrode much more reliable in continuous use at high currents, thus resulting in less dissociation.

Porosity in aluminium welds can result from the presence of hydrogen in the weld which, when it cannot escape, remains in the form of small pockets of gas. The cleanliness of the parent metal, filler rod, etc., is clearly important.

Many of the defects mentioned above are removed or

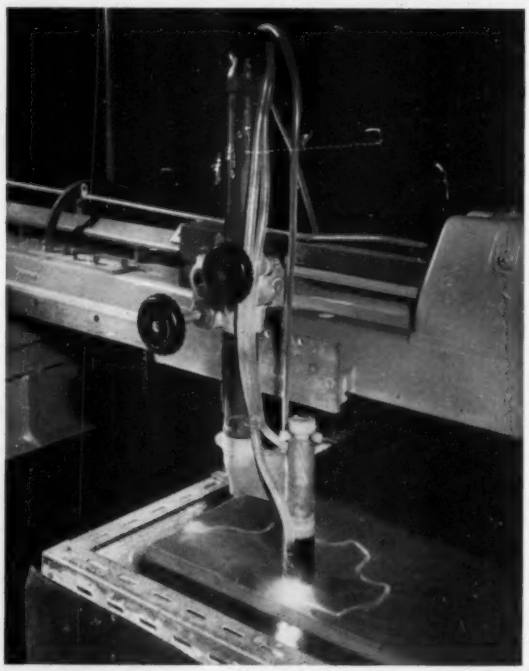


Fig. 3.—The recently developed arc cutting process for aluminium, showing the cutting of complicated profiles in thick aluminium plate

alleviated when the welding process can be " mechanised." Automatic welding is widely applied therefore and is to be recommended in all cases of continuous production (Fig. 2).

Developments in Argon-Arc Welding

Some time ago the research laboratories of the G.E.C. developed a " twin-arc " process in which two arcs were struck from two tungsten electrodes in a shield of argon.[1] This process has been used most satisfactorily in the production of aluminium tubing by welding up from strip.

Another development of argon-arc welding that has not, as yet, been applied to aluminium is the " argon-arc spot-welding " method. In this process the torch is placed on top of, and in contact with, the two sheets that have to be spot welded together. The arc is struck and fusion occurs as far as the interface between the two sheets. Due to the double-oxide film between the lapped surfaces of the aluminium, however, it has not been possible to obtain satisfactory fusion. It is possible nevertheless to obtain arc spot welds by methods discussed elsewhere.

Arc Cutting

A development of the argon-arc welding technique that has received much attention recently is the " arc cutting " of aluminium.[2] In this process, a constricted arc of extremely high temperature is struck between a tungsten electrode and the work-piece, under a high-speed jet of inert gas. The concentrated and columnated energy of the arc stream melts and ejects a thin section of metal to form a kerf. The process provides clean, quick cutting, in metal thicknesses up to 1in and greater, and on ½in thick plate a typical cutting speed is 6 ft/min (360ft per hour) (Fig. 3). Work in this country started by using an argon/hydrogen gas mixture for cutting, but investigators soon found that nitrogen gas performed the job equally well and at a lower cost. Above ½in, gas mixtures of nitrogen and hydrogen are generally required to obtain satisfactory results. Once the arc is struck, molten metal is ejected from the underside of the plate to yield a clean cut face with dross-free edges. There is a tendency for some of the molten metal to cling to the underside of the cut surfaces, but, in general, the cleanness of the face is similar to that produced by normal mechanical methods. Several problems arose in the development of suitable nozzles and arcing devices but these have been successfully overcome. To strike an arc in these somewhat special gas mixtures, a pilot arc device had to be incorporated in the torch.

Use of Consumable Electrodes

A logical and important development of these argon-arc welding techniques followed after investigations in the United States. This was the self-adjusting arc welding process, variously known since as the " consumable electrode process " and the " inert-gas metal-arc welding process." Essentially, there are two fundamental differences from the argon-arc technique. First, the tungsten electrode is replaced by a consumable aluminium electrode which acts also as the filler rod and is continuously fed forward through the gun from a wire reel. The arc is struck between the tip of this wire and the work-piece and thereafter the wire melts continuously into the weld pool (Fig. 4).

Secondly, the operation is controlled by the " self-adjusting arc principle," such that as the wire speed is pre-set the rate of " burn-off " of the aluminium wire varies, to keep a constant arc length between the tip of the wire and the work. This is of considerable importance

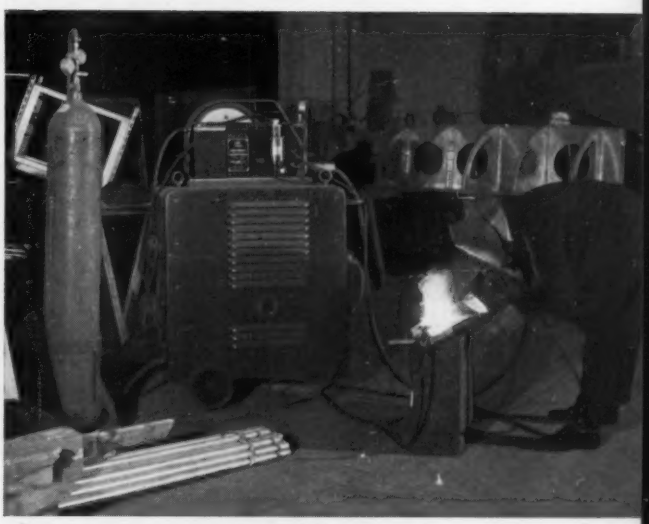


Fig. 4.—The inert-gas metal-arc welding process showing the ease with which the welding gun can be manipulated

in practical welding because it enables the process to be used without a great deal of manual dexterity and without constant attention to irregularities in the work surface. From further developments of this process the " controlled arc process " has been evolved in which the rate of feed of the electrode is electronically controlled by the arc voltage. Both types of operation are now incorporated in modern welding equipment, and because of the great value of this process in the construction of aluminium marine structures and chemical vessels considerable effort has been devoted to development and improvement.

Electrical Characteristics

At current densities as low as 10,000 A/sq in the transfer of molten metal across the arc in inert gases is in fairly large globules. The size of these globules decreases at higher current densities, and at about 50,000 A/sq in the transfer changes suddenly to a spray of fine droplets crossing the arc at very high velocity (so called " spray transfer "). Thus, welding can be carried out successfully in all positions without difficulty, this being one of the main advantages of this process.

Power sources for this process can be of three types, drooping, flat or rising, according to their volt-ampere characteristics. Until recently the power sources commercially available consisted of standard d.c. welding generators, or rectifiers having a high open circuit voltage and a steeply drooping output characteristic. As such the optimum operating conditions are obtained by trial and error, the wire feed speed being adjusted until it matches the current in the welding circuit at the required arc length. Thus the process has never been completely satisfactory and the self-adjusting arc has been the subject of a detailed study by the Electrical Research Association in conjunction with the British Welding Research Association, the results of which have been published[3] particularly with regard to the power source.

There are several inherent disadvantages in the use of drooping characteristic power sources. For example, the tendency to porosity may be greater following on the use of too short an arc length. Fortunately this defect is revealed by spluttering of the arc. Short circuits can also

occur and the wire can "burn back" into the contact tube. Ideally, therefore, the volt-ampere characteristic curve of the power source should match the characteristic of the arc, but while equipment with a rising characteristic represents the ultimate in suitability a substantially flat characteristic (or constant potential) power source is a great improvement on the drooping characteristic rectifiers and motor generators commercially used up to the present (Fig. 5). The development and use of substantially flat characteristic equipment marks a great step forward.[4]

In America, the process known as "Filler-Arc," developed by the American General Electric Co., is claimed to give the best results yet, but this is not yet available in this country. In current British equipment the filler wire is pushed forward through drive rolls

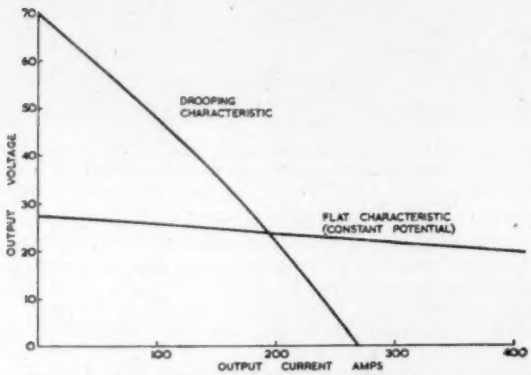


Fig. 5.—Typical curves illustrative of power sources having flat and drooping characteristics

situated in the body of the equipment, via a long lead to the welding gun and thence the work. This leads to wire speed fluctuations resulting in arc length changes and "burn backs." In the "Filler-Arc" equipment the drive rolls are located on top of the welding gun and the wire is therefore pulled forward from the wire reel. This gives a more even flow of wire with less tendency to buckling and permits the use of smaller diameter wires.

There are, nevertheless, few problems associated with the consumable electrode processes, and when operating correctly there is little risk of trouble. Tendency to splutter can arise when welding the aluminium-magnesium alloys, but the flat characteristic power source reduces this risk to the minimum. The operating voltage is of considerable importance in the use of these welding processes; ideally, the actual arc voltage, not the nominal open circuit voltage, should be measured—for example, between the welding wire as it leaves the gun, and the work-piece.

A full study of these processes has revealed a definite range of wire feed speeds and operating currents within which good quality welds are assured. Outside this range, defective welds can occur, namely in the "sub-threshold" and "defective" ranges, due to the use of currents that are too low and too high respectively. Using low wire feed rates, transfer of the weld metal is intermittent and in globular form, rather than by spray transfer and this results in a poor deposit and no weld. At high wire feed rates (defective range) serious defects can occur in the weld deposit (puckering) and internal voids (tunnelling) can be produced: in extreme cases the arc can cut right through the plate. These defects arise from gross turbulence and the entrapment of oxide, and are often associated with high currents as well as high wire feed speeds.

The British Welding Research Association have developed a special welding nozzle that incorporates a secondary flow of argon (Fig. 6) and it has been found that a greater flow of shielding gas enables the equipment to be used at wire speeds and currents much higher than possible hitherto, thus permitting the deposition of greater amounts of metal without risk of oxide film entrapment. It has been found possible to weld 1in thick aluminium plate in two passes, one pass from each side.

This development and others like it indicate the very detailed attention that is being given to these processes and although there are still some problems to be solved, they are largely mechanical and solutions will no doubt be found in due course.

Stud Welding

As already noted, the use of aluminium for ships' superstructures and decking is becoming commonplace and this has introduced certain problems, particularly in the fixing of deck timbers to the aluminium structure. The stud welding process, as used with steel, has for many years been used with aluminium with considerable success. However, the wider use of the aluminium-magnesium alloys in conjunction with studs of increasing diameter (up to $\frac{3}{8}$in) has introduced certain problems that did not exist in earlier days.

The soundness and efficiency of such joints is important and it has been found, for example, that even small fluctuations in power supply can result in a bad weld. Other factors contributing to weld quality are cleanliness of the stud and the plate, apart from close control of the electrical details, current, voltage and impact force. Unless full attention is paid to these aspects, oxide film can be trapped in the weld, and porosity and lack of fusion can occur. More reliable stud welds can be achieved when argon shielding is applied at the critical moment when the arc is struck and the stud melted. Consistently good joints are obtained and strengths are high. This argon shielding technique has been used for many years in the United States and on the Continent. Although some satisfactory results can be obtained without the use of an inert gas, less attention need be paid to other troublesome factors that would otherwise be in the hands of the operator when this method is used. Experiments are continuing in this country to establish the efficiency of this technique. Aluminium studs are used in the fixing of

Fig. 6.—The special welding head developed by B.W.R.A. incorporating a secondary argon circuit for overcoming defects in the welding of thick aluminium plate

insulating panels to the shell plating of ships, but in this case the stud diameter rarely exceeds $\frac{3}{16}$in diameter and no great strength is required.

Conclusions

These modern arc welding methods for aluminium have the following advantages:—

(1) Flux-free welds, with no risk of post-weld corrosion.
(2) Fully positional welding.
(3) Sound welds.
(4) High speed of welding.
(5) Less distortion.
(6) Narrow heat affected zone, with little effect on parent metal properties.
(7) Suitable for automatic operation and mechanised welding.

Welding is a means of achieving a permanent low-resistance joint and these methods are used in making internal joints in transformers. Busbars are also welded in this way and Fig. 7 illustrates a flexible joint in aluminium made by the argon process. Stranded cable terminations are also welded as are bunches of rectangular strip conductors.

Following the successful use of argon-arc techniques with aluminium, many industries using many metals now make use of the principles established with aluminium. Similarly, the self-adjusting arc process has now been adapted to the welding of mild steel and other metals. Undoubtedly there is room for improvements in the techniques, but in the relatively short time that these processes have been available in this country it has become apparent that the efficient and economic use of aluminium alloys on a wide scale in British industry has been materially assisted by these processes.

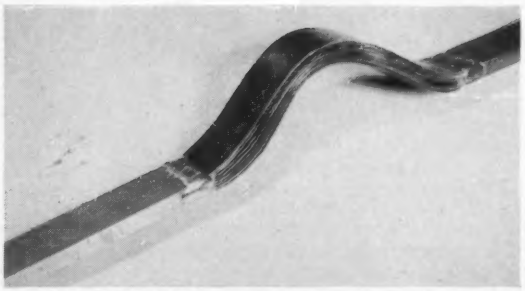


Fig. 7.—Busbar expansion joint in pure aluminium, indicating the versatility of argon-arc welding in joining thin material to thick

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Expansion of Technical Training Colleges

THE number of places available for students who wish to train to become technical teachers is to be increased by over 60 per cent, and substantially higher rates of grant are to be paid to students. A letter has been sent from the Ministry of Education to the three training colleges (in Bolton, Huddersfield and London) which offer special courses for prospective teachers in technical colleges, informing them of the new grant arrangements, which have been agreed by the Minister, Mr. Geoffrey Lloyd, and the local authority associations. The Minister is already consulting local education authorities about the necessary building work at the three colleges.

The full details of the new scales of grant to students will not be known before the completion of the triennial review of the standard figures of maintenance for students at universities, and of training college grants, which is now in progress, but the final settlement will include increased personal grants to students, together with travelling expenses. Dependants' grants will also be increased, and married students, or students with dependants who have to maintain separate homes, will receive a special grant. In addition to these grants, which are provided by the students' home authorities, students will normally receive free tuition and their own board and lodging. Account will be taken of other income in assessing a student's grant.

Increased grants for these particular students are considered necessary because the technical training colleges need to recruit almost entirely people from settled occupations in industry and commerce. The principle accepted by the Ministry and the local authority associations will be that a married student with one or more children and a separate home to maintain, who is receiving grant while attending a course of pre-service training, should be no worse off financially than if he were in fact earning the basic minimum salary of a Grade A assistant in a technical college (at present £475).

It is expected that the technical colleges will have to recruit over 2,000 new full-time teachers a year to make good losses and provide for expansion. The arrangements outlined in the Ministry's letter are designed to increase the number and improve the quality of those who enter the profession through the technical training colleges. Much larger numbers are recruited direct from industry. Details of arrangements designed to improve recruitment from this source will shortly be the subject of a circular to authorities. It is proposed also to establish courses of full-time training for technical teachers already in service. The Minister will soon be discussing with the associations concerned the financial assistance to be given to teachers seconded to such courses.

All these new developments are the result of recommendations made by a Special Committee on the Supply and Training of Teachers for Technical Colleges which was set up by the Minister of Education in 1956. A new standing committee has been set up, under the chairmanship of Dr. Willis Jackson, F.R.S., director of Research and Education, Metropolitan-Vickers Electrical Co., Ltd. (who was also chairman of the Special Committee) to keep under permanent review matters concerned with the supply and training of teachers for establishment of further education. It is one of the standing committees of the Minister's National Advisory Council on the Training and Supply of Teachers, and includes representatives of local authorities, technical colleges, technical training colleges, university institutes of education, and industry and commerce.

Caps for Fluorescent Tubes

Their Evolutionary Development

By W. A. R. STOYLE, B.Sc., A.M.I.E.E., F.I.E.S.*

THE choice of caps for use with fluorescent tubes has, over the years, been a subject of considerable controversy. The recent introduction by the General Electric Co., Ltd., of the recessed double contact (r.d.c.) cap while appearing, at first sight, to complicate an already confused situation, may prove to be a vital step in fluorescent tube development.

The use of b.c. caps on fluorescent tubes, which were first marketed in Great Britain in April, 1940, was influenced by the fact that such caps and suitable holders were immediately available. In the U.S.A., however, b.c. caps were not standard and as it was impracticable to use e.s. caps on fluorescent tubes a new cap, the bi-pin, was introduced.

As a satisfactory cap and holder combination the standard British b.c. system is unlikely to be bettered from both the mechanical and electrical points of view, but it must be admitted that æsthetically and because of the sheer bulk of cap and holder the bayonet capped tube compares unfavourably with the bi-pin arrangement. On the other hand, the mechanical fragility of the pins of a bi-pin cap has always been a source of some difficulty, particularly during insertion into the tube holder. This was particularly the case with the " tombstone " type of holder illustrated in Fig. 1, where considerable torque on the pins could be exerted, although new types of tube holders such as the " push-on " or " retractable " types illustrated in Fig. 2 have considerably improved this situation.

Much criticism has also been voiced with regard to the mechanical strength of the bi-pin cap in general handling and in transit, some manufacturers finding it advisable to protect the pins by a cardboard ring. Many caps are damaged by standing the tube on one end on the ground during installation work. There is also a possible shock hazard with both bi-pin and b.c. caps if one end of the fluorescent tube is inserted into its holder, and body contact is made with the cap contacts at the free end. Such a shock would not, of course, occur if the fitting was properly switched off, but one cannot be quite certain that this will always be the case.

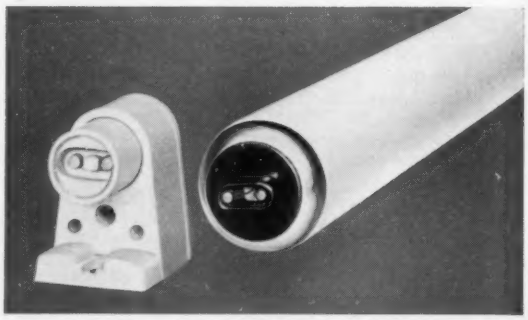

Fig. 4.—New tube holder showing the recessed contacts in the central moulded spigot and spring-loaded plungers

In assessing the virtues of the bi-pin cap and holder combination one must remember that when it is required to butt tubes together to produce a continuous line of light the " dead " space between tubes is much less than that with b.c. caps and holders. Some concept of the difference can be gained from Fig. 3 showing the conventional b.c. arrangement and two combinations of bi-pin caps and contemporary holders. As the physical size of the cap and holder combination is reduced so is the overall length and cost of associated fittings and this factor has doubtless played its part in the now almost universal use of the bi-pin cap.

After assessing the chief characteristics of b.c. and bi-pin caps it

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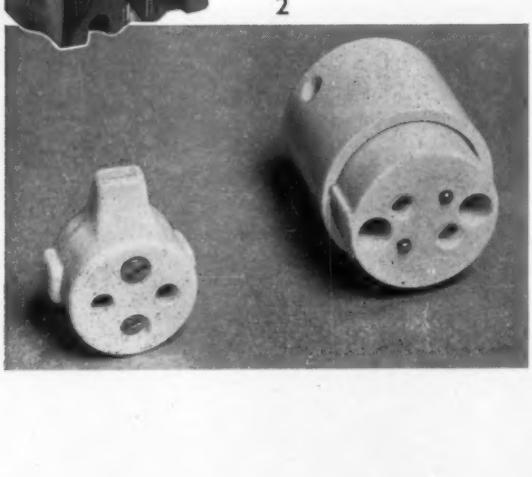

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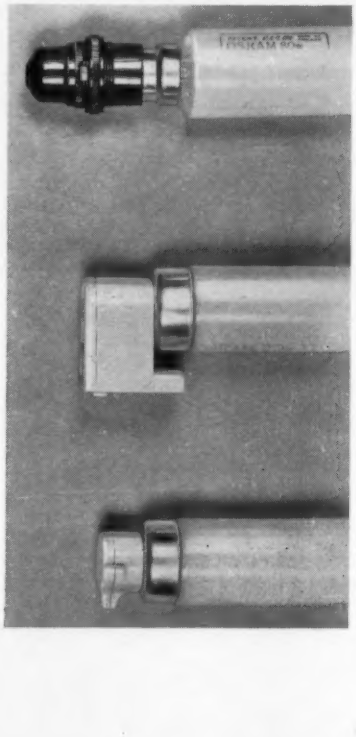


1. *Fig. 1.—A " tombstone " type tube holder*

2. *Fig. 2.—A " push-on " tube holder (left) and a retractable tube holder*

3. *Fig. 3.—(Top) A conventional b.c. tube holder and two types of bi-pin holders*

is clear that both types have material advantages and disadvantages but that neither type really presents a satisfactory solution to the problem. Ideally, the requirements are compactness, adequate mechanical strength, electrical safety and, finally, a low electrical contact resistance.

The recessed double contact (r.d.c.) cap, illustrated in Fig. 4, appears to meet all the requirements quoted. This cap has a solid moulded bridgepiece of insulating material containing two solid contacts between which is a small recess which engages with a raised section in the special retractable type tube holder which is also illustrated. The contacts are "untouchable," so there is no risk of shock if a tube is inserted in a "live" fitting. The solid bridgepiece also engages in an appropriate recess in the tube holder providing accurate location and good electrical contact. Tubes may easily be installed in fittings from a single position and by one person; this is often a difficult procedure with existing caps and holders.

FUEL POLICY

Committee to Consider Gas—Electricity Co-operation

METHODS of improving co-operation between the Area Electricity and Gas Boards in the performance of their statutory functions and in the administration of services of a like kind are to be considered by a special committee to be set up by the Government, Lord Mills, Minister of Power, announced in the House of Lords last week.

In a debate on the development and use of the nation's fuel and power resources, several peers had asked if the Government had a co-ordinated fuel and power policy. Lord Mills replied that regular meetings were still held between the chairmen of the nationalised fuel and power industries, and he and his officials. "In my judgment, co-ordination of that kind involving day-by-day and continual study of the position and taking the necessary steps to deal with it is preferable to a superimposed planning board which, for example, would find it difficult to keep in daily touch with the industries themselves and would probably indulge in theoretical exercises," said the Minister. "I do not think such an organisation is necessary because of the close scientific studies which are going on all the time to ensure that we have a properly thought-out and co-ordinated fuel policy."

Consumers' Needs

So many things determined the pattern of fuel usage—technical considerations, consumers' preferences and the question of price. The requirements were dictated by millions of customers who probably knew better than any "gentlemen in Whitehall" could, what they needed and what was best for them. Competition between the various kinds of fuel was to be expected if people were to have freedom of choice and he had seen no overwhelming proof that it led to a waste of resources. Even if waste could be found, he was sure that it would not be greater than that which would ensue if a body of officials tried to settle what fuel was good for people to use.

"There is, however, one sphere of competitive activity which attracts a considerable volume of criticism," he continued. "That is the kind of competition between the gas and electricity industries which at times and in places is quite strong. Critics feel that there is an avoidable duplication in the distribution services of the gas and electricity industries. Criticisms have been made, for example, of the duplication of showrooms in the same town, one devoted to electricity and the other pressing the claims of gas. Since taking office I have heard these views expressed on a number of occasions. Advisers have looked at this problem before and have come to the conclusion that there was nothing in it, but I feel that the time has arrived when we might usefully have a look at the matter again."

Hire-purchase had been restricted for some time and the nationalised industries had not been able to increase the amount of capital that they had out in hire-purchase. The committee would be asked to make recommendations on this subject. The committee would consist of both full- and part-time representatives of the gas and electricity industries, with independent members and an independent chairman.

In answer to questions, he said that the committee would consider everything to do with the retail distribution of gas and electricity—meter reading, sales of appliances, etc. Expenditure on advertising would also come within its scrutiny.

The debate was initiated by Lord Macdonald of Gwaenysgor, who called attention to the development of fuel and power resources and to the need for closer co-ordination between the authorities.

In Wales he had found that there was increasing co-operation between the Gas, Electricity and Coal Boards, particularly on the use of methane gas, but he would like to know whether it was so satisfactory elsewhere. The Minister should say whether he was in favour of a national fuel policy. If he was, did he have the necessary scientific advice behind him to control the implementation of such a policy?

Lord Teviot suggested that the Government should consider placing nuclear power stations in areas where large coal production was now petering out.

Lord Hall commended the decision to reduce the planned use of oil fuel in power stations. He hoped that, should the present coal situation continue, the Minister would reconsider the other 17 new and converted power stations and make them coal-burning.

Differing Views on Hire-Purchase

Lord Hawke did not want the Gas and Electricity Boards to increase the amount of hire-purchase, saying that it would be far more economic to let private capital run the hire-purchase and to use the money that the Boards had tied up in that way for other capital requirements.

Lord Lawson disagreed with Lord Hawke on this point. He was anxious to see more people using electricity for cooking and heating, and thought it was right that they should obtain cookers, space heaters and immersion heaters on hire-purchase through the Electricity Boards.

Lord Mills, replying to the debate, said that a turning point had been reached in the use of fuel and power. Since 1948 coke consumption had gone up by 15 per cent, gas by 27 per cent, and electricity by 99 per cent. Before the war these refined products accounted for only a quarter of inland fuel consumption. Now they accounted for 40 per cent or more. He wanted to plan to make more coal available for export.

The power station oil conversion programme was continuing but had been reduced by one-third from the nine million tons which was contracted for by 1960-61. The reductions represented a relinquishment of contractual rights by the oil companies, and he had come to the conclusion that it would be most unjust to press them further.

The turning point in our fuel and power affairs came with the advent of nuclear power, making us a three-fuel instead of a two-fuel nation. But he agreed that too much stress could not be placed on the fact that in our day and age coal was, and would remain, the very foundation of our fuel economy.

Nuclear power made a very big claim on our savings, and one way in which we could economise was just to put back the programme for a little time. We should not lose anything; the difference would be made up by conventional power stations. " ZETA " was the beginning of the road rather than the end.

To test underground gasification of coal a pilot plant was under construction and if the results were satisfactory arrangements would be made for a bigger station. It was promising, but he would not like to say more at present.

Reactor Computations

THE discussion on the four papers relating to nuclear reactors and counters read before the Measurement Section of the Institution of Electrical Engineers last week (see *Electrical Review*, 7th February, page 272) was opened by Dr. D. Taylor (Plessey Nucleonics, Ltd.), who praised all the authors concerned and emphasised the importance of the work.

Mr. F. R. Farmer (United Kingdom Atomic Energy Authority) said that the difficulty was how to marry the behaviour of the complex machine with the experiments carried out on it. How could one develop the theory, whether by machine or digital computer or simplified methods, to enable one to continue building and improving the reactors which were an essential part of the country's economy ?

Mr. A. Gilmour (English Electric Co.) said that a convincing argument had been made out in favour of the biggest and fastest computers for nuclear reactor design studies. There was a danger here that the onus of getting a problem done quickly might be placed more on the machine than on the human being. Even with a very high-speed machine it was still necessary to pay careful attention to the numerical method that was used. The organisation of the programme and the use of appropriate programme techniques was important if operating time was to be saved.

Professor A. Porter (Imperial College) commented on the advances that had been made in the past few years. He referred to the Larc and Stretch machines sponsored by the United States Atomic Energy Commission and to the importance of the ultra-high-speed computer from the national point of view. He suggested that this country ought to have such a machine to cope with extremely complex three-dimensional reactor problems in a reasonable time.

Mr. R. W. Sutton (English Electric Co.) stressed the importance of accuracy. Referring to the paper by Bowen and Masters, he pointed out that the first step was to set up a mathematical model to represent the system under examination. Errors between computation and behaviour could arise in various ways and the obvious course was to try to eliminate them in turn. This could be done by studying a range of values on a parameter and finding out which parameters were significant. Methods such as those suggested in the paper were extremely useful.

Mr. D. V. Wordsworth (U.K.A.E.A.) pointed out that the paper by Dr. Howlett did not enter into much detail about the thermodynamic design and the kinetic behaviour of the system. Considerable economic gains could be obtained by optimisation of the relationship between heat output and overall plant efficiency. They might well cover the cost of the computer required to achieve them. Kinetic behaviour must be taken into account in the early stages of design study.

Mr. Grattan (U.K.A.E.A.) said that Dr. Howlett had dealt admirably with design difficulties but it was a pity his choice of examples did little to dismiss the attitude so frequently adopted, that this was a straightforward calculation so why not put it on a machine ? The real need was for fast general approximate methods of performing general survey work, both in the machine sense and from the point of view of the designer controlling the investigation. In his experience, for every hour on the machine about one hundred man-hours were required to formulate the problem, prepare the input data and assess the results.

Mr. T. J. O'Neill (G.E.C.) observed that Messrs. Bowen and Masters had simplified the equations to such an extent that they could be solved with little effort. He was a little worried, however, lest they might have made too many assumptions, thus distorting the answers to an unacceptable degree.

Mr. A. L. Gray (Plessey Nucleonics) suggested that the fission counter had applications not only in small reactors, where low fluxes required the counter to be placed close to the core, but to some of the larger graphite-moderated reactors.

Testing Insulating Materials

THE first of a series of recommendations being prepared by the International Electrotechnical Commission relating to standardised methods of test of the electrical properties of insulating materials is now available (No. 93, 6 Swiss francs, from the I.E.C. Central Office, 1, rue de Varembé, Geneva).

Part 1 of the document defines quantities measured and gives general information on the tests and states minimum requirements for the test report. Part 2 makes recommendations for shapes of test specimens and electrodes for solid insulating materials, cells for liquid insulating materials, calculations of volume and surface resistivities, conditioning, applied voltage, and mounting specimens. The use of various types of electrodes and arrangements of measuring circuits are illustrated by seven figures.

What Every Dealer Should Know

GUIDANCE FOR THE LAY PUBLIC

By E. H. W. BANNER

T.D., M.Sc., M.I.E.E., F.Inst.P., M.Cons.E.

TO enter a store and ask for one thing and to be offered another is not conducive to continued business. To enter a store with a knowledge of what is wanted and still to be supplied with it under a wrong name may not at first cause trouble, but it will in later stages by various repercussions.

This goes on regularly in some electrical and radio dealers' shops where, through either ignorance or carelessness, the customer is sold what he wants under a false and misleading name. Many dealers know the correct names for the articles in question but excuse their action on the grounds that the customer always knows the articles by the names he, the customer, uses. Others apparently only know the wrong names.

A multiple store with a counter displaying electrical equipment commonly dispenses with labels or other designations on items on show and is concerned only with marked prices. The assistants in fact probably have little idea what they are selling, in many instances, and so there is some excuse for their not knowing the correct names. But this does not apply to electrical and radio dealers, who should know what they are selling and, especially, should be competent to advise and guide the customer. This is important: a dealer should be able to explain convincingly why the green conductor of a flexible cord should be connected to the earthing pin of a three-pin plug, for example.

Nor are Electricity Board showrooms always correct in their terminology, and this is more serious as they have better standing by virtue of their engineering staffs and acknowledgment of the British Standards Institution who determine nomenclature, and the I.E.E. Wiring Regulations which they, the Boards, purport to follow.

Two examples will make clear the type of misleading salesmanship referred to, and probably many readers will immediately see the error when put in this way.

First, a call in an Electricity Board showroom by the writer, asking for a 5 A shuttered socket-outlet. The assistant fetched a sample plug in a socket-outlet, pulled one from the other and asked " Do you want a plug or a plug top ? " proffering one at a time. On being told again what was wanted, he seemed completely lost and had apparently never heard of the name " socket-outlet." At a later date an inquiry at a dealer's shop for a 13 A plug produced the same counter question " Do you want a plug or a plug top ? "

Next, on calling at another Electricity Board showroom a display board was seen, including among other items two switched socket-outlets, but both labelled as "switches and plugs."

It is easy for a dealer or showroom assistant to say that he supplies just what the customer wants. But the dealer should know what he is talking about, although the customer often does not. The electrical dealer should lead, not follow bad practice by blaming the customer's error.

Some dealers excuse their action by saying there is no standard; it all depends on what anyone thinks about it. Two authorities exist, either being a complete answer to this view. The British Standards Institution by its Glossaries defines the correct terms and in this instance B.S. 1363 is the relevant Standard for these items. It is called " Two-pole and earthing pin fused-plugs and shuttered socket-outlets for a.c. circuits up to 250 volts." The correct terms are also employed in the Regulations for the Electrical Equipment of Buildings, 13th edition, published by the Institution of Electrical Engineers, which should be familiar not only to those who install equipment but also those who sell it, since they ought to be competent to advise on such points as current ratings and the correct equipment to satisfy the various regulations.

Some manufacturers of electrical equipment and accessories carry out excellent publicity for domestic electrification, including the advocacy of ring circuits, by issuing leaflets with full information and typical sketches of layouts. As these are widely distributed by showrooms it is a poor return for the dealer to deny the correct terms to the customer who, if he follows the leaflet, is misled by the dealer.

Electrical dealers should be competent to advise on safety matters in selling electrical equipment, unlike the assistant in the multiple store who knows only the price of the goods. In time it is likely that the 13 A flat pin fused-plug and shuttered socket-outlet to B.S. 1363 will be nearly universal, but it will be many years before this is the case as houses, fortunately, last for many years. On this account, existing round-pin 5 and 15 A plugs and socket-outlets will persist for a long time even in domestic premises. But two-pin plugs and socket-outlets do not now conform to the I.E.E. Regulations (13th edition), and although, no doubt, many of them will persist it is desirable for the dealer to point out to the customer that they do not conform to good modern practice, thus putting the onus on the purchaser, who would not otherwise know.

No doubt many purchasers will say that if manufacturers still make them they must be all right—and his existing sockets may be only two-pin anyway.

Many manufacturers of electrical equipment now very wisely supply their goods with three-core flexible cord and a tie-on or other label showing to which terminal in the plug each colour core should be connected. It is still advisable for the dealer to try to ensure that the customer understands this, however, and in the case of those items of equipment which do not carry such a label, to make clear to the purchaser exactly what each coloured core means and how it should be connected—if he will connect it himself, as is usual.

Two exceptions arise here, and the dealer should know these to be able to deal with them. They both concern twin flexible cords: first, is the all-insulated electrical equipment such as a table lamp where no earthing terminal is possible, and secondly, the obviously metal-clad article such as a vacuum cleaner, with double insulation to B.S. 2754 which may be marked " Need not be earthed." In both cases the customer, perhaps well

reminded that only three-pin plugs should be used with a three-core flexible, will require to be satisfied why in these two cases it is not dangerous to omit the earthing connection. Of course the earth contact in the socket-outlet should be connected to earth, but this should have been done in the installation stage, quite independently of whatever might subsequently be plugged in. He should also be reminded that the three-pin plug (to B.S. 1363) is still required, although the earth pin will not be connected to the flexible cord.

While the flat-pin plug to B.S. 1363, rated at 3 kW or 13 A at 240 V, is provided with fuse clips to take fuses of various ratings, in fact it is unusual to find anything other than a 13 A fuse. This is sufficient to protect the ring circuit itself and so does not seem as if it could be bettered, but it is often forgotten that the fuse in the plug can, if correctly chosen, often protect both the appliance and its flexible cord. The provision of a 13 A fuse for, say, a 100 W table lamp with a thin flexible cord will not necessarily protect the cord when a short-circuit occurs in the switch in the lampholder, whereas a minimum size fuse may do so. B.S. 1362, entitled "Cartridge fuse-links for use in plugs" covers ratings of 3, 7 and 13 A. Some fuses on the market are interchangeable with these but cover ratings of 2, 5, 10 and 13 A.

Liquid Vapour Resistance Starter

A NEW technique of starting slip-ring motors is announced by Lee Guinness, Ltd., Newtownards, Northern Ireland. To ensure full exploitation of the "Vapormatic" starter, the company is already building a new factory of 55,000 sq ft in Northern Ireland with provision to double that area in a short time.

Although a simple and robust piece of apparatus, the "Vapormatic" rheostat automatically regulates the resistance in the rotor circuit to provide the exact power required by the motor at any given moment during the start. This results in the application of continuous torque and much smoother acceleration than has been possible with conventional industrial starters. The action of the "Vapormatic" rheostat, which is made under licence from A.O.I.P.—Berard (France), is based on the great difference in resistance of a liquid electrolyte compared with that of its vapour (of the order of 1:50).

In its simplest form, the apparatus consists of two electrodes opposite each other in a small chamber of insulating material. This chamber is submerged in a tank of electrolyte with which it communicates by means of orifices calculated to offer a given resistance to the flow of liquid. When a current is passed through the electrodes across the chamber, the resistance of the electrolyte causes local heat which results in the almost instantaneous vaporisation of the liquid electrolyte between the electrodes. The chamber is therefore immediately filled with vapour and the resistance in the the circuit is at its maximum (see Fig. 1).

Vaporisation takes place only when the current passing across the chamber exceeds a certain critical value. Below this point the current crosses the chamber without causing any vaporisation. Above this critical point vaporisation takes place at an increasing speed in direct relation to the increase of the current. Thus, if the current passing across the chamber is at a value above the critical point and diminishes to a value below that point, the resistance introduced into the circuit will vary proportionately from a high value (corresponding to the chamber being full of vapour) to a low value (corresponding to it being full of liquid).

To utilise this principle for the control of slip-ring motors, the apparatus is constructed as shown in Fig. 2. The neutral or star point of hexagonal section contained in an electrode chamber of steatite is shown suspended in the tank. The electrode chamber is constructed to provide three compartments, of predetermined volume, each containing the lower end of one electrode and one segment of the star point. The electrode chamber is in communication with the electrolyte in the tank by means of orifices in the sides of the chamber. The rheostat is connected to form the star point in the rotor circuit of a slip-ring motor.

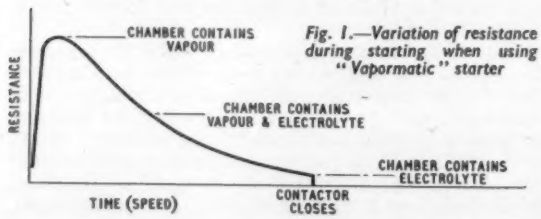


Fig. 1.—Variation of resistance during starting when using "Vapormatic" starter

When the stator of the motor is connected to the line, the current induced in each phase of the rotor passes down the electrodes and across the small volume of liquid electrolyte in the three compartments of the electrode chamber to the star point. At the moment of starting, the current induced in the rotor circuit is much higher than the predetermined critical point of the apparatus and therefore produces an almost instantaneous vaporisation of the liquid electrolyte between the electrodes and the star point. A high resistance is therefore inserted in the rotor circuit.

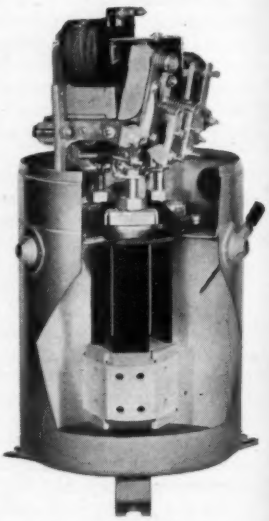


Fig. 2.—"Vapormatic" resistance starter

During the starting cycle, as the motor accelerates the rotor current gradually reduces so that the rate of vaporisation is decreased and the liquid electrolyte tends to return progressively to the chamber, expelled vapour being condensed in the main volume of liquid in the tank. The resistance inserted into the rotor circuit, which is in direct proportion to the ratio of liquid to vapour in the electrode chamber, is therefore reduced in direct relation to the rotor current. When the starting cycle is completed the electrode chamber is once more filled with liquid electrolyte, the conductivity of which is sufficient to carry the full load rotor current which is below the critical point of the apparatus so that no further vaporisation takes place. At this point, the resistance in the circuit is at its minimum and the rheostat may be short circuited by the contactor.

Lee Guinness "Vapormatic" rheostats are made in one size only. Each unit, by simple regulation of the volume of the electrode chamber (by means of inserts), is capable of starting a motor of up to 40 h.p. over a very wide range of starting conditions. For larger motors it is only necessary to connect in parallel additional units at the rate of one for every further 40 h.p. required, so that a single stock of "Vapormatic" units will cover the entire range of slip-ring motors in any industrial organisation. "Vapormatic" starters are less than half the size of conventional slip-ring motor starters of equal capacity and are lower in price.

VIEWS on the NEWS

By REFLECTOR

AT a meeting of the Malvern Hills Conservators (reported by the *Manchester Guardian*) Mr. R. H. M. Bartleet said that he did not know that pylons were really quite so hideous as they were claimed to be. Somebody had referred to the "ruthless march" of pylons through the countryside. Mr. Bartleet asserted (echoing a thought once expressed, I believe, by Lord Citrine):—

"Practically all the works of man are hideous for about four hundred years and then they become scheduled as ancient monuments. I dare say that when the Romans threw their aqueducts across valleys the local inhabitants were shocked at the time. One can foresee the time in about a thousand years when some Peruvian archæologist poking about among some ruins will regard these pylons as extremely beautiful."

* * *

Writing to *Public Service* (the N.A.L.G.O. journal) an electricity service supervisor says that the amalgamation of gas and electricity showrooms suggested in an article by Mr. W. B. McArthur (commented on in the *Electrical Review* of 17th January) holds no attraction for him. He says:—

"I have spent some 15 years preaching the benefits of the all-electric home, and my belief has been confirmed by personal experience over a number of years. A man cannot serve two masters. If the public is to get good service from any industry, that industry must be staffed by people who believe in it."

While I wholeheartedly agree, I wish that I could believe that all electricity service centre staffs were confirming the benefits of electricity from personal experience.

* * *

Pity the Electricity Boards who are between the upper millstone of would-be customers and the nether one of rural preservation. Mr. J. E. Shepherd, manager of the Lakeland Sub-Area of the North Western Electricity Board, was "grilled" at a recent meeting by irate people who want a supply of electricity, particularly by a Mr. Highton. As reported in the *Whitehaven News*:—

"He blasted the Board good and proper, but he also lashed those so-called 'amenities societies' who are, for what they consider æsthetic reasons, putting obstacles in the Board's way."

Mr. Highton refused to be pacified by Mr. Shepherd's suggestion that all rural area demands would be met in the next ten years, remarking:—"A lot of us will be dead by then."

* * *

In recent years, outlet sockets have been developed by the gas industry with ingenious interlocks to prevent misuse by children. Is it not time that we had a "child-proof" design of the 13 A ring main socket outlet? More attention seems to be paid to interlocks on industrial outlets which, after all, are used by people who should know what they are doing, than those for domestic use. It is amazing how easily tiny fingers can get round the finger-guard. The answer would seem to be a fully interlocked switch since contact covers can be defeated and are, in fact, an attraction to the ingenious child.

* * *

After all the fuss there has been in Scotland about "freedom of choice" it is somewhat startling to read in the *Glasgow Herald* some remarks by Sir Patrick Dollan, chairman of the Scottish Fuel Efficiency Committee, when opening a "Space Heating by Electricity" Exhibition in Glasgow last week. He said:—

"In five or ten years' time it would be compulsory for all houses in Scotland to be designed and fitted for electricity . . . and people would have to accept it. Individuals would be unable to say what they wanted; they would have to take the fuel service that the country could offer at an economical price."

* * *

The Editor of *Regional Power*, the new magazine of the Eastern, London and South Eastern Region, is either very sure of himself and his colleagues or he is taking a serious risk. After apologising for errors in his first issue he offers to give a guinea to the Electrical Industries Benevolent Association (which he calls "Institution") in the name of the person who first draws attention to an error in the journal.

* * *

A book on "Electric Wiring and Fitting for Plumbers and Gasfitters" was noticed in the *Electrical Review* of 14th February, 1908. The reviewer quite plainly took a poor view of it; he said:—

"The thoughts suggested to our minds on lifting this volume were twofold. First, that the class for whom it is obviously intended are very much in need of a text-book; and secondly, that the 'old order changeth,' and that the electrical contractor, who was really an electrical engineer, is being slowly but surely ousted by the plumber and gasfitter with a little and often dangerous knowledge of electrical matters. The thoughts in our mind, on laying down this book, were that the author has in no way enhanced his reputation by it, and that there is still a sporting chance for the *electrical* contractor."

He proceeded to enumerate the many faults of the book. He pointed out, in connection with tests of the insulating property of conduit enamel:—

"One particularly foolish test, embellished with a diagram of connections, no less! is given on p. 91; we fear its only result will be to teach some enterprising young plumber's apprentice that electrical burns are painful. Though a razor may be safe in a man's hand, it is risky to entrust it to a child."

I am somehow reminded of to-day's "do it yourself" literature.

INDUSTRY AND THE HOUSE

Points From the Fuel and Power Debate

By A. M. F. PALMER, A.M.I.E.E., M.Inst.F., M.P.

IN the coming week the House of Commons will be discussing Parliamentary reform, for we shall be asked to give a second reading to the Life Peerages Bill. With the merits or demerits of this measure it is not my business to deal in these columns. It will, at least, draw attention to the continuing importance of their Lordships' House in our constitutional arrangements. I expect, in the course of the debate, attention will be drawn once again to the alleged quality—if not the quantity—of words uttered in the "other place." It will be contended that the House of Lords is still a forum for objective discussion under circumstances impossible in the more partisan atmosphere of the Commons.

Well, objectivity, restraint, and the pleasant exchange of courtesies were much to the front last week when Lord Macdonald rose to call attention to the "development and use of the fuel and power resources of the United Kingdom" and to the need for "closer co-ordination between the responsible authorities."

Coal Mining Problems

Lord Macdonald is an ex-miner and naturally one would expect him to be, as he is, a sturdy champion of the coal industry and sympathetic towards its difficulties. He pointed out that coal was being still raised from mines sunk 300 years ago. Only 20 per cent of United Kingdom coal was from mines sunk since the end of the first world war; all the rest came from pre-first-world-war mines. Between the wars nothing had been done to sink new pits; the result was that the Coal Board had been left to start on a new, long-overdue course of pioneering developments. Returns were bound to be slow; in the meantime, with an extractive industry the output inevitably showed a tendency to shrink. This had to be counteracted all the time.

After being frank about failings in the matter of absenteeism—here Lord Macdonald was able to throw some light due to his understanding of the outlook of the mining community—he reminded the House that the cost of production of coal in this country was the lowest in Europe. He gave some figures, taking a standard grade of coal for comparative purposes: per ton, France 239s, Belgium 217s, Holland 170s, Western Germany 167s, Britain 126s.

Moving away from production, Lord Macdonald discussed the second leg of his motion in the matter of "closer co-ordination" between the authorities responsible for the use of coal. Had the Minister of Power the necessary scientific advice which could enable him to follow a national fuel policy? He did not believe that it was wise for the country to continue with the fuel and power industries acting separately. Lord Leathers, the fuel "overlord" of some years ago, had said in 1952 that co-ordination had been carried as far as it could go. Although Lord Macdonald disputed this, unfortunately he did not himself tell his listeners just what co-ordination meant to him in everyday practice.

Lord Stonehaven, who spoke immediately after Lord Macdonald from the Government side, stressed the view that atomic energy, whether of the fission variety or the possible future fusion type, could not affect the importance of coal to the industrial existence of the United Kingdom until well into the middle of the next century. From this he went on to draw attention to the third annual report of the National Industrial Fuel Efficiency Service. He said the survey carried out by the Service last year covered 1,200,000 tons of consumed coal and indicated that a saving of between 18 and 20 per cent could, in their opinion, have been readily obtained. If this could be taken as authentic, and he felt sure it could be, it meant that overall there was a possible national saving each year of between 7 million and 10 million tons. The Fuel Efficiency Service had also found that an investment of just over £1,000,000 would save about 100,000 tons of coal annually; or £10 per ton of coal saved. The economic adviser to the Coal Board had gone on record as saying that it was in the national interest to spend capital up to £50 to save one ton of coal per year. If that be true, asked Lord Stonehaven, how much more right it was to spend £10!

I did not hear the whole of the debate, but from reading the Hansard report it seems to me that his Lordship made a telling point when he underlined the scandal of factories and works which continue to use the old-fashioned Lancashire boiler—a champion fuel waster. He contrasted the thermal efficiency of such boilers with the efficiency of up-to-date power stations and drew the appropriate moral—more electrification.

Minister's Reply

The short debate which started at 2.30 p.m. was wound up just after 6 o'clock by the Minister of Power, Lord Mills. Since the Minister's speech was presumably a statement of Government fuel and power policy, it is worth the while of the electricity industry to look at it closely.

Lord Mills remarked that for many years now Britain had been basically a two-fuel nation; energy had come mainly from coal or oil. Coal was the foundation of Britain's fuel economy, but the importance of oil was growing. To the suggestion that oil should be curtailed because it was imported and subject to overseas political change, Lord Mills said he could no more stop the use of oil than King Canute could stop the sea. Since 1948, whereas consumption of coal had increased by 10 per cent, oil use had increased by 91 per cent. Taking all fuels together, to-day 60 per cent was consumed by industry and commerce, 27 per cent by the domestic consumer and 13 per cent by transport of one kind or another. Half the coal was passed on to other industries to make energy of another kind, with the second half being shared: industry and commerce 26 per cent, homes 18 per cent and 6 per cent for transport. Lord Mills said that the power station coal-oil conversion programme had been reduced by one-third, but it was not intended to stop it altogether since the electricity industry had entered into long-term contracts with oil companies.

The Minister came in the end to the controversial topic of "co-ordination" and claimed he had a valuable scientific department in his Ministry under the leadership

of a distinguished scientist. This, he thought, was quite capable of giving him independent advice in carrying out his statutory duties in respect to overall fuel and power policy. In addition there were regular meetings of the chairmen of the Boards, often with himself and/or his principal officials present. For these reasons he rejected suggestions of a superimposed planning board. Such a body might indulge in theoretical exercises and ignore realities.

There were many things which determined the pattern of fuel usage — technical considerations, consumers' preferences and price. Fuel requirements were called for by the demands of millions of consumers who probably knew better than "any gentlemen in Whitehall" what they required and what was best for them. There was, however, one sphere of competitive activity which attracted criticism; that was too much rivalry and duplication in relation to the gas and electricity industries. Although advisers had looked at the problem before and had concluded that there was nothing in it, Lord Mills felt that another investigation might well be carried out. Hence, a special committee would be established to report on ways and means of "improving co-operation between Area Electricity and Gas Boards in the performance of their statutory functions."

Lord Greenhill wanted to know if the committee would look at "unnecessary advertising." Lord Latham was anxious that they should look into "the economics of dual meter reading." The Minister assured the noble Lords that these matters and apparently much else would be thoroughly turned over. I can only say that I feel it would be unwise to be too rigid, but at the same time any attempt to handicap one industry in order to prop another should be resisted.

550 MW Reheat Boiler

THE Central Electricity Generating Board has indicated to International Combustion, Ltd., its intention to order from that company a 550 MW power station boiler which, it is believed, will be the largest single unit under project in the world.

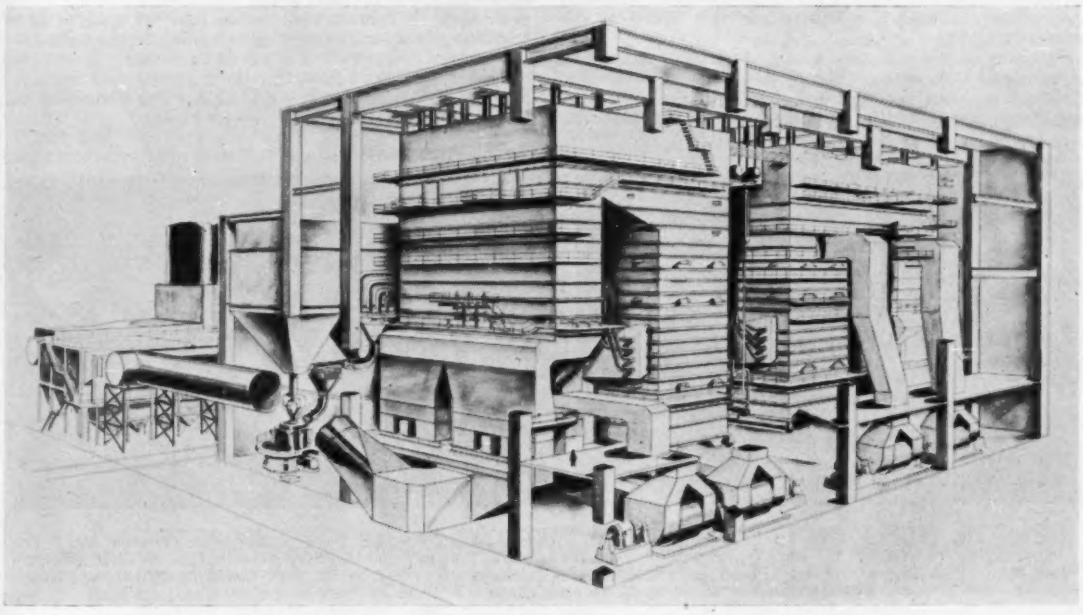
The boiler will serve the requirements of a corresponding 550 MW turbo-alternator which is also very much larger than any now in operation. This plant will have an output greater than that from any one of the Board's existing power stations.

The 550 MW boiler and its associated generating set is projected for installation in the power station which it is proposed to construct at Thorpe Marsh, near Doncaster. Application has been made by the Central Electricity Generating Board for the consent of the Minister of Power to the establishment of a 1,100 MW station on this site.

A station of this size, which will cost approximately £40 million, will require more than 2½ million tons of coal a year. Because of the large fuel consumption, coal will be drawn from a wide area covering the Yorkshire coalfield and the northern parts of the Nottinghamshire coalfield. The quality of the coal will vary over a wide range with ash contents from 6 per cent to 30 per cent and moisture from 4 per cent to 20 per cent. Special steps will be taken in the design of the boiler to enable this range of characteristics to be accepted. The hourly coal consumption of each boiler will be between 205 tons and 220 tons, depending on the coal quality.

The boiler unit is designed for a continuous maximum

Artist's impression of the International Combustion 550 MW controlled circulation boiler unit



rating of 3,750,000 lb of steam an hour, at a pressure of 2,400 lb per sq in and a temperature of 1,055 deg F. As is customary with large modern units, the steam, after passing through the high-pressure turbine, will be returned to the boiler for reheating to the original temperature of 1,055 deg F before it is passed through the remaining stages of the turbine. The feed water enters the boiler at a pressure of about 2,600 p.s.i. and a temperature of 496 deg F at full load.

The boiler has two furnaces, each being sub-divided into two sections fully cooled by water or steam tubes. One furnace controls the main steam temperature and the other the reheat steam temperature. The furnaces are each 68ft wide, 28ft deep and 100ft high. The main drums of the unit are nearly 150ft above ground level. Careful design has been required to limit this height, as in a 200,000 kW boiler the drum is at a height of about 135ft and there is a natural tendency for height to increase with size.

The circulation is of the assisted type. All the water tubes in the furnace and elsewhere are fed at regulated rates by pumps of a special type. The motors driving the pumps are water immersed to avoid the necessity of bringing out the moving shafts through the pressure casings.

Firing is with pulverised fuel through burners in the corners of each furnace from which the flames are directed to form a vortex in the centre. There are eight pulverising mills, four to each furnace and of such capacity that three are adequate for full load, leaving the fourth free for maintenance. These mills have a nominal maximum capacity of 50 tons an hour each.

As the coal will include some of the most difficult in the country in respect of propensity to choke the boiler with deposits, the design embodies a number of features suggested by the Generating Board's continuous programme of research on this subject.

The boiler will have four rotary air heaters and four sets of fans per unit. The latest designs of mechanical and electrostatic dust cleaning plant will be installed to clean the chimney gases, at a cost which represents something in excess of 10 per cent of the cost of the boiler plant as a whole.

The guaranteed efficiency of the unit is 90 per cent.

Birmingham I.E.E. Dinner

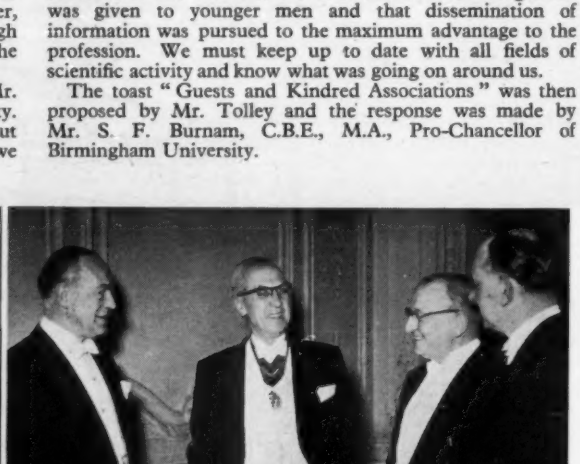
THE annual dinner of the South Midland Centre of the Institution of Electrical Engineers was held at the Grand Hotel, Birmingham, last Friday, under the chairmanship of Mr. L. L. Tolley, B.Sc., M.I.E.E.

The toast of the Institution was proposed by the Lord Mayor of Birmingham, Alderman J. J. Grogan, M.B.E., J.P., who briefly reviewed its history and praised all concerned with the progress which had been made since its inception. The South Midland Centre was formed in the early years of this century and now had some 3,500 members. He applauded the work which the Institution was doing to attract young men into the industry.

The response was made by Mr. T. E. Goldup, C.B.E., President of the I.E.E., who said that he was delighted to receive the two ladies who were present at the dinner, saying that this was perhaps a sign of the times, although the number of women members was very small at the moment.

Referring to the recent launching of earth satellites, Mr. Goldup said that these opened up new fields of possibility. This country had not launched these space vehicles, but the reason was not that we lacked engineering skill; we had neither the money nor the resources, since they had been expended in two world wars. However, the principles behind these satellites had their roots in research done in this country. The fundamental contributions of this country were exceedingly great. After referring to Calder Hall, "ZETA" and the transatlantic telephone cable, all of which had been British developments, the President said we could be prevented from giving further help by a shortage of engineers and scientists. This problem had been with us for a long time—too long. At present we were spending four times as much on armaments as we were on education. Were we sowing seeds we would regret in the future? To hold on to and increase our present standard of life we must see to it that full encouragement was given to younger men and that dissemination of information was pursued to the maximum advantage to the profession. We must keep up to date with all fields of scientific activity and know what was going on around us.

The toast "Guests and Kindred Associations" was then proposed by Mr. Tolley and the response was made by Mr. S. F. Burnam, C.B.E., M.A., Pro-Chancellor of Birmingham University.



Left: Miss E. G. Dodd, B.Sc.(Eng.), A.M.I.E.E. (left) and Mrs. B. Roland, B.Sc.(Eng.), A.M.I.E.E., being received by the chairman, Mr. L. L. Tolley, and the President, Mr. T. E. Goldup (right). Right: Mr. S. F. Burnam, Pro-Chancellor University of Birmingham, Ald. J. J. Grogan, Lord Mayor of Birmingham, Mr. W. S. Lewis, chairman, Midlands Electricity Board, and Mr. C. J. O. Garrard, past-chairman, South Midland Centre

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Mr. J. A. Wedgwood

Mr. D. Moffat

Mr. C. A. French

Mr. F. A. Rawlings

Mr. R. Y. Sanders

Mr. R. D. V. Roberts

Mr. L. H. Kent

Mr. W. J. Hendry

The Electricity Council has announced a number of further appointments. **Mr. J. A. Wedgwood,** M.A., A.C.I.S., who becomes deputy secretary of the Council, has been deputy secretary of the London Electricity Board since 1955. He began his career in the electricity supply industry when he joined the British (later Central) Electricity Authority before vesting date. He subsequently served as personal assistant to Mr. H. F. Carpenter, secretary of the Authority, and from 1951 to 1955 was an administrative officer in the Secretary's Department of the C.E.A., leaving there to take up his appointment with the London Board.

Mr. D. Moffat, M.B.E., is appointed as chairman of the superannuation schemes and for special duties. Before joining the British Electricity Authority as director of establishments in 1947 he was assistant secretary in the Establishments Division of the Ministry of Fuel and Power.

Mr. C. A. French, A.S.A.A., A.I.M.T.A., who becomes a deputy to the financial adviser, has been a deputy chief accountant at C.E.A. headquarters since October, 1956. After service in various municipal finance departments he became deputy borough treasurer of Smethwick in 1942. He joined the Central Authority at headquarters in 1948 and became assistant chief accountant in 1949.

Mr. F. A. Rawlings, O.B.E., who is also appointed a deputy to the financial adviser, was, until the end of last year, finance officer of the C.E.A. He has been in the electricity supply industry for over 40 years. From the Electric Lighting Department of the Board of Trade he joined the staff of the Electricity Commissioners at the inception of that body in 1919 and when the Commissioners were dissolved in 1947 he was their financial officer. Upon the reorganisation of the industry he was appointed an assistant secretary to the Central Authority and became finance officer in 1952.

Mr. R. Y. Sanders, F.S.S., is appointed deputy commercial and development adviser. Mr. Sanders, who had been an officer of the C.E.B. since 1927, joined the B.E.A. early in 1948 as a deputy commercial manager and more recently has been the deputy chief commercial officer of the C.E.A. He has been the chairman of the Utilisation Research Committee of the Central Authority and the Area Boards since its inception and also a member of the Electricity Supply Research Council. For some years he has served on committees of the U.N. Economic Commission for Europe and the O.E.E.C. and on the Directing Committee of UNIPEDE. He was a member of the delegation from the supply industry which visited Russia in 1956.

Mr. R. D. V. Roberts, B.Com. (Lond.), becomes a deputy to the industrial relations adviser. He graduated from the London School of Economics and has been secretary of the National Joint Advisory Council of the Electricity Supply Industry since 1949 and deputy director of welfare of the Central Authority since 1953. Before entering the Authority's service Mr. Roberts was deputy chief district officer to the Miners' Welfare Commission. He was a member of the electricity supply productivity team which visited the United States in 1949.

Mr. L. H. Kent, B.A., B.C.L., has been appointed deputy legal adviser. He has been an assistant legal adviser to the Central Authority since 1948. Mr. Kent was educated at Rugby and Corpus Christi College, Oxford, and was called to the Bar at Lincolns Inn in 1925. From 1926 to 1941 he practised in China under the extra-territorial jurisdiction of the British Crown and in the Courts of various other nationalities. When he came to England, after service in the Indian Army, he was for two years an assistant solicitor with the Ministry of Agriculture and Fisheries.

Mr. W. J. Hendry, who becomes public relations officer, has been deputy public relations officer of the Central Authority since 1948 and was previously Press liaison officer of the C.E.B. He was for over 20 years on the London staff of the *Glasgow Herald* and served for the greater part of that time in the Press Gallery of the House of Commons.

The London Electricity Board has appointed **Mr. B. C. O. Murphy,** B.Com., who is at present in charge of the Administration Branch in the Secretary's Department of the Electricity Council, as deputy secretary of the Board. This follows upon the appointment of Mr. J. A. Wedgwood as deputy secretary of the Electricity Council.

Mr. Murphy was educated at the Imperial Service College and the London School of Economics. During the war he served in the Royal Irish Fusiliers. After temporary service with H.M. Treasury, Mr. Murphy joined the then British Electricity Authority headquarters in 1949 as an administrative assistant, later being appointed administrative officer (personnel) in the Establishments Branch. On Mr. Wedgwood's appointment in 1955 as deputy secretary of the London Electricity Board Mr. Murphy was transferred to the Committees and General Administration Branch of the Central Authority.

A number of new appointments have been made by the United Kingdom Atomic Energy Authority.

Mr. J. C. C. Stewart, formerly director of technical policy in the Industrial Group at Risley, becomes a deputy managing director of the Industrial Group; **Mr. J. B. W. Cunningham,** formerly deputy director

(civil reactors), becomes director of industrial power in the Industrial Group; **Dr. R. Hurst,** formerly chief chemist in the research and development branch of the Industrial Group at Risley, becomes director of the Dounreay Experimental Reactor Establishment; and **Mr. D. S. Mitchell,** formerly director of administration, becomes director of personnel and administration in the Industrial Group. **Mr. D. W. Fry,** chief physicist at Harwell, has been appointed a deputy director of the Atomic Energy Research Establishment and will take up his new post on 17th February.

The President of the Board of Trade has appointed **Mr. D. W. Morphy,** a joint managing director of Morphy-Richards, Ltd., as a member of the Council of Industrial Design.

The South of Scotland Electricity Board has announced the appointment of **Mr. R. J. Rennie,** B.Sc., M.I.E.E., as manager of the Lanarkshire Area of the Board, and of **Mr. G. F. Moore,** B.Sc., M.I.E.E., as manager of the Ayrshire Area. Both appointments take effect from 1st April when the present managers, **Mr. D. Smith** and **Mr. A. E. Roots,** retire.

Mr. Rennie entered the electricity supply industry in 1926 with the Glasgow Corporation Electricity Department and in 1928 he joined the Clyde Valley Electrical Power Co., Ltd. He remained with that company until 1939 when he was appointed assistant distribution engineer with Central London Electricity, Ltd. Subsequently he was appointed district chief engineer and later development engineer with that company. In 1948, on the nationalisation of the electricity supply industry, Mr. Rennie was appointed operation and maintenance engineer with the South West Scotland Electricity Board, becoming deputy chief engineer in 1951, and on the reorganisation of the industry in Scotland in 1955 he was appointed distribution engineer of the South of Scotland Electricity Board.

Mr. R. J. Rennie

Mr. Moore entered the supply industry in 1929 with Dundee Corporation Electricity Department. In 1935 he was appointed deputy mains superintendent, Carlisle Corporation Electricity Department, and in the following year he joined Kirkcaldy Corporation as deputy burgh electrical engineer, becoming burgh electrical engineer and manager in 1938. In 1943 he was appointed borough electrical engineer and manager of Keighley, which appointment he held until 1948 when, on nationalisation, he was appointed manager of the Lothians Area of the South East Scotland Electricity Board. On the amalgamation in 1956 of the Edinburgh, Lothians, and Southern Areas of the South of Scotland Electricity Board to form the Edinburgh and Borders Area, he was appointed deputy manager.

Mr. N. T. Burgess, A.I.M., A.M.Inst.W., who writes in this issue on "Fusion Welding of Aluminium," studied metallurgy at Battersea Polytechnic after a period in the Analytical Department of the Royal Mint Refinery. Subsequently he was engaged on the mechanical testing of materials and on the development of structural applications of the metal at the Research Laboratories of the British Aluminium Co. at Gerrards Cross, Bucks. In 1955 Mr. Burgess took up his present position on the metallurgical staff of the Aluminium Development Association where he is particularly responsible for development and technical liaison on all matters pertaining to the joining and fabrication of aluminium with particular regard to welding.

Mr. N. T. Burgess

The electrical installation and wiring in many houses in Britain to-day was not only inadequate but was also obsolete, said Mr. A. N. Irens, chairman of the South Western Electricity Board, in Bristol on 7th February. He was proposing the toast of the **Electrical Contractors' Association** at the annual dinner of the Association's Bristol Branch. Mr. Irens said that very few homes were properly equipped to take full advantage of the range of electrical devices now available. In many houses the electrical installation itself was incapable of providing adequate facilities for the use of electricity to any extent. In the West Country one consumer in every ten had not even a 5 A outlet, and only two or three consumers in ten had outlets over 5 A capacity. The average number of socket outlets per home in the South West was now only slightly over three. The working formula for a minimum standard of lighting and power points, agreed between Electricity Boards and local authority associations, provided for seven power points and cooker and water heating circuits in each modern home. This was a definite step forward, but by modern standards it was still inadequate.

A dance was held by **M.K. Electric, Ltd.,** on 30th January at the Assembly Hall, Walthamstow, at which long-service employees received awards. Neither of the founder directors was able to be present, but Mrs. C. L. Arnold and Mr. R. W. Dowsett, deputy general manager, attended. Mrs. Arnold presented gold watches to nine employees with twenty-five years' continuous service.

Mr. J. C. Alderman, A.M.I.E.E., has been appointed to the new post of safety engineer in the Chief Engineer's Department of the South of Scotland Electricity Board. Mr. Alderman is at present assistant regional safety officer, Yorkshire and North Eastern Region, of the Electricity Council.

Mr. T. Wilkinson of the Metallic Seamless Tube Co., Ltd., Leeds, is now recovering after a short period in hospital. He has represented the company in Leeds for forty-two years. **Mr. Maurice T. Wilkinson** (his son) has been appointed Leeds depot manager. The services of Mr. T. Wilkinson will still be available to the company in a consultative capacity.

Mr. N. G. Worster, A.M.I.E.E., A.M.I.Mech.E., A.I.Loco.E., F.B.H.I., has been appointed chief development engineer of Measuring Instruments (Pullin), Ltd. He was formerly with S. Smith & Sons (England), Ltd., where he had been responsible for the design of many of the group's products, including aircraft, motor accessory and industrial instruments, electric clocks and traction control gear. He was educated at the Mercers' School, Holborn, and Northampton Engineering College.

Mr. N. G. Worster

Mr. D. C. Underwood, who hitherto has represented J. Day & Co. (Derby Works), Ltd., in the East Anglian area, has been appointed sales manager.

At the London offices of Chloride Batteries, Ltd., on 4th February, **Mr. H. E. Bayman** was presented with a set of three fishing rods and tackle and a bookcase by members of the staff. The presentation was made by

Mr. H. E. Bayman (right), receiving a presentation from Mr. C. Pritchett, to mark his retirement from Chloride Batteries, Ltd.

Mr. C. Pritchett to mark Mr. Bayman's retirement at the end of 1957 as manager of Exide and Drydex replacement sales in this country. He had been with the company for twenty-five years.

In order to concentrate under one director all matters relating to the Steering-Gear Division of George Kent, Ltd., the general supervision of this section of the company's activities is being undertaken by **Mr. L. A. C. Bartlett,** A.M.I.Mech.E., who is relinquishing his duties as commercial director of the Instrument Division. As a result of this change and to give closer liaison between the sales and the research and development organisations, **Mr. R. S. Medlock,** B.Sc., A.R.I.C., A.M.I.Mech.E., A.M.I.E.E., has been appointed as technical and home sales director. He assumes responsibility for the Contracts Department, home sales representatives and service and erection, in addition to his duties as director in charge of research and development. It has been decided to establish a central organisation in Australia under the direction of **Mr. E. E. Cook,** M.Inst.F., whose position as home sales manager is being taken over by **Mr. J. Tham.** Mr. Cook expects to leave for Australia, with his wife and family, on 15th February. **Mr. K. Scanes,** previously exhibitions manager, has taken over from Mr. Tham the responsibility for relations with overseas subsidiary companies. **Mr. W. G. Askew,** publicity manager, has assumed responsibility for the Exhibitions Department. **Mr. W. T. H. Carter** has been appointed chief buyer for the Instrument Division.

The Eastern Electricity Board has appointed **Mr. S. F. Osborne,** M.I.E.E., A.C.I.S., commercial officer of the Surrey Sub-Area of the South Eastern Electricity Board, to be manager of the Northmet Sub-Area in succession to Mr. C. C. Hill, who was recently appointed the Board's chief engineer. Mr. Osborne received his technical education at the Manchester College of Technology and the Regent Street Polytechnic and his engineering training with the English Electric Co., Ltd. After early company experience, he became the consumers' engineer to the Ealing Corporation, a position he held until 1935. From 1935 until the outbreak of the last war, he was a sales engineer with the Yorkshire Electric Power Co., and for the succeeding five years was a district manager with that organisation. For the two years before nationalisation, Mr. Osborne was district manager (Twickenham) with the London and Home Counties Joint Electricity Authority. He is an associate member of the British Institute of Management.

Mr. S. F. Osborne

At the Ipswich and District Electrical Association's dinner. Left to right: Judge T. F. Southall, Mr. H. V. Pugh (chairman, Eastern Electricity Board), Mr. R. Ratcliffe (Mayor of Ipswich), Mr. R. A. Jackson (chairman of the Association), Mr. C. T. Melling (member of the Electricity Council), Dr. A. H. Morris (Bishop of St. Edmundsbury and Ipswich), and Mr. A. Hill (senior surgeon, Ipswich and East Suffolk Hospital)

The annual dinner of the Liverpool Branch of the **Electrical Contractors' Association** is being held at the Exchange Hotel, Liverpool, 2, on 3rd March. Tickets, price £1 10s, are obtainable from the hon. treasurer, Mr. A. E. Chesters, 2, Atherton Street, New Brighton, Wirral, Ches.

Mr. N. Larder and **Mr. V. R. Gunthorpe,** both of Grimsby, have been appointed executive directors of T. Beadle & Co., Ltd., of Hull. They will both continue with the duties on which they are at present engaged.

At the monthly luncheon of the **Electrical Industries Club** at the Connaught Rooms, London, on Tuesday, with Mr. A. F. Plummer, the president, in the chair, the guest speaker was Mr. Ted Kavanagh, the well-known B.B.C. script writer. He entertained the hundred or so members and guests with a short address on the subject of the microphone and the significant part it had played in establishing the radio and television personalities of to-day. Mr. E. G. Batt, vice-president, proposed the vote of thanks. The next luncheon of the Club will be held on Tuesday, 11th March.

The electrical industry should make its objects better known to the public by avoiding "pseudo-scientific jargon," it was urged at the annual dinner of the **Ipswich and District Electrical Association** on 7th February. The speaker was Mr. C. T. Melling, a member of the Electricity Council and formerly chairman of the Eastern Electricity Board. He was responding to the toast to "The Electrical Industry" which had been proposed by Judge T. F. Southall.

The chairman of the Eastern Electricity Board, Mr. H. V. Pugh, defended the supply side of the industry when he proposed the toast to the Association. Despite complaints, he said, it provided excellent service. Responding, the chairman, Mr. R. A. Jackson, Ipswich District manager of the Eastern Electricity Board, said that a nuclear power station was already being built not far from Ipswich and he hoped the area would be considered for a "ZETA" station. Other speakers were Mr. A. White, Ipswich manager for the G.E.C.; the Mayor of Ipswich, Mr. R. Ratcliffe; and the Bishop of St. Edmundsbury and Ipswich, Dr. A. H. Morris.

Mr. W. A. R. Stoyle, B.Sc., A.M.I.E.E., F.I.E.S., who writes in this issue on "Caps for Fluorescent Tubes" (page 294), received his early education at the Methodist College, Belfast, and obtained an honours degree in electrical engineering at Queen's University, Belfast. After serving a two years' apprenticeship in heavy engineering at the G.E.C.'s Works at Witton, Mr. Stoyle joined the staff of the G.E.C. Research Laboratories, Wembley, in 1930 and transferred to the technical section of the Osram Lamps Department at the head office of the company in 1933.

Mr. W. A. R. Stoyle

Mr. Stoyle has presented a paper on optical refraction in opal glasses to the Institute of Glass Technology, and during the past 20 years he has contributed many articles to electrical and scientific journals, chiefly on fluorescent tubes and associated subjects.

Mr. A. Rubach has been appointed managing director of the newly formed Penco Research & Development Co., Ltd. The company will co-ordinate engineering development and design within the Pena group. Laboratory facilities for research and advanced studies will also be available to other companies. At the end of the war, while still in the Army, Mr. Rubach was seconded to the Ministry of

Supply for guided weapons research. Subsequently he was appointed assistant superintendent of experiments at the inception of the guided weapons trials range at Aberporth and a member of five technical panels on the Directorate of Guided Projectiles. Since 1946 his positions have included those of engineer in charge of the electronics laboratory of the engine research section of the Anglo-Iranian Oil Co., Ltd., and senior development engineer of A.P.T., Ltd., where he was responsible for the engineering design and manufacture of "MOSAIC" (Ministry of Supply automatic computer). Before joining Pena he was a leading scientist and head of the Experimental Engineering Department at the G.E.C. Applied Electronic Laboratories at Stanmore.

Mr. A. Rubach

OBITUARY

Mr. Robert K. Fleming, M.I.P.E., F.R.M.S., hon. president of the Igranic Electric Co., Ltd., died on 3rd February at the age of sixty-six.

The late Mr. R. K. Fleming

Mr. Fleming received his training with D. & J. Tullis, Clydebank, and after a period as test engineer in the Engine and Turbine Section of Jas. Howden & Co., Ltd., he was appointed chief engineer at the Lochburn Iron Works, Glasgow, in 1917. From 1920 to 1924 he was superintending engineer (Scotland) with the Harland Engineering Co., Ltd., and in the last-mentioned year commenced his association with the Igranic Electric Co., being appointed general manager in 1937 and managing director in 1941, a position he held until 1953 when, through ill-health, he was compelled to give up active management, but became chairman of the board. He was a founder member of the British Institute of Management.

Mr. F. Groombridge, contract manager to Leonard J. Ive, Ltd., Watford, died on 8th February.

Mr. Frank Grindrod, managing director and co-founder of Hardman & Co., Ltd., electrical and radio wholesalers, and Philco Distributors (Lancashire), Ltd., of Rochdale, died on 2nd February at the age of sixty-one. Mr. Grindrod founded the firm of Hardman & Co., Ltd., in 1920 in partnership with his wife, Mrs. Lucy Grindrod, and Mr. Robert Hardman (now of Robert Hardman, Ltd., Leeds). Mr. Grindrod was vice-president of the Electrical Trades' Commercial Travellers' Association.

Mr. K. D. Marsden, who for more than thirty years had represented J. A. Crabtree & Co., Ltd., in North Wales and West Lancashire, died on 2nd February. Mr. Marsden received his early engineering training with the Renault Co., of France, and joined J. A. Crabtree & Co. in 1925, moving almost immediately to Liverpool to develop the north-western sales area.

Mr. John T. Grassie, formerly managing director of Lawson, Turnbull & Co., Ltd., electrical factors, 8-18, Mealmarket Street, Aberdeen, died on 7th February at the age of seventy-five. He had spent all his working life with the company, rising from office boy to managing director; he retired in 1955 but continued to be a member of the board.

WILLS

Mr. J. W. Kendall, head of the Nuclear Engineering Development Department of John Thompson, Ltd., who died on 24th August last, intestate, left £12,933 gross (£8,758 net).

Sir Arrol Moir, Bt., M.I.C.E., vice-president of the Institute of Patentees, and past-president of the British Institution of Radio Engineers, who died on 8th August last, left £10,575 gross (£9,307 net).

Mr. B. G. Drummond, M.I.E.E., formerly general manager of the East Anglian Electric Supply Co., Ltd., the Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Co., and the Newmarket Electric Light Co., who died on 22nd October last, left £31,997 gross (£31,525 net).

Mr. J. W. Berry, deputy managing director of Birmid Industries, Ltd., and joint managing director of the Birmingham Aluminium Casting (1903) Co., Ltd., who died on 5th August last, left £31,270 gross (£27,943 net).

Mr. R. O. Wright, formerly works manager of the Gravesend works of W. T. Henley's Telegraph Works Co., Ltd., who died on 28th October last, left £18,653 gross (£18,186 net).

PRICES OF MATERIALS

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £197 0s 0d
COPPER, H.C. Electro	ton £162 10s 0d
Fire Refined 99·70%	ton £161 0s 0d
Fire Refined 99·50%	ton £160 0s 0d
COPPER Tubes ..	lb 1s 7½d
Sheet	ton £191 10s 0d
H.C. wire and strip ..	ton £212 15s 0d
LEAD, English ..	ton £73 10s 0d
Foreign	ton £72 0s 0d
MERCURY	flask £74 0s 0d
TIN, block (English) ..	ton £730 5s 0d
ZINC, G.O.B. Foreign	ton £65 5s 0d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 1s 4½d
Sheet	ton —
Wire	lb 2s 2½d
PHOSPHOR BRONZE Wire	lb 3s 4½d
PLATINUM	oz £28 10s 0d
RUBBER, No. 1 R.S.S. spot	lb 22½d—23d

Two-Millionth B.T.H. Motor

ON Tuesday last the two-millionth electric motor to be manufactured at the Blackheath, Birmingham, Works of the British Thomson-Houston Co., Ltd., came off the production line. To mark the occasion a party of distinguished visitors toured the works and were afterwards entertained to lunch. The Mayor of Halesowen, Cr. P. W. Scott, was accompanied by the town clerk and senior representatives of local education, government and Press interests together with industrialists and representatives of the Midlands Electricity Board.

Mr. E. H. Ball, managing director, presided at the lunch and welcomed the guests. During the tour the visitors inspected various departments of the works and saw something of the modern methods and processes employed in the manufacture of electric motors. The two-millionth motor is a 5 h.p. machine destined for Canada, and was therefore of particular interest to Mr. W. A. McAdam, C.M.G., Agent General for British Columbia, and Mr. H. Leslie Brown, Commercial Counsellor for Canada, who were among the visitors.

Some of the motors (to British Standard dimensions) manufactured in the B.T.H. Blackheath, Birmingham, Works

High Polymers

FORTY-NINTH KELVIN LECTURE

BEFORE the forty-ninth Kelvin Lecture was delivered by Dr. H. W. Melville, K.C.B., F.R.S., at the Institution of Electrical Engineers in London last week, Mr. H. T. Young, past-president, was presented with a vellum certificate recording his election as an Honorary Member of the Institution and the Faraday Medal for 1958 was presented to Sir Gordon Radley, K.C.B., C.B.E., Ph.D.(Eng.).

Speaking on "Relations Between Chemical Constitution and Physical Properties of High Polymers," Dr. Melville gave a survey of a number of sciences which were trying to evaluate the properties of new materials which were made by the chemist and used by the chemist, the physicist and the engineer.

The term "high polymer" was a new one, but high polymers were in fact quite old substances. Natural rubber and celluloid, which had been discovered and developed in the 19th century, were high polymers. The term merely meant that, instead of dealing with small molecules with a few atoms in them, one now dealt with big molecules where the number of atoms comprising the molecule might range from 1,000 to 100,000.

One of the most important properties of these materials was that the molecules were lineal; it was this long-chain characteristic which gave immense scope for the design of new materials. The fact that the substances consisted of long chains of atoms meant that the properties of the substances depended to a great extent on the length of those chains. Here the chemist could be extremely helpful, because to these long chains of atoms one must attach various other groups of atoms, and these could be changed chemically over a very wide range and also had a very important effect on the properties of the materials in these substances.

Each of the atoms in the chain had a rapid rotary motion, so that, in general, a simple chemical molecule of this kind was in a continual state of motion, with the result that the shape of the substance was changing continually. This type of motion meant that if there was a long chain of atoms in these high polymer substances, the molecule was not strung out but assumed a much more compact shape, the average shape being approximately spherical. The natural tendency was for the long chain of atoms to assume a more or less coiled-up configuration, so that the actual difference from one end to the other was not in proportion to the number of atoms involved, but the square root of the number of atoms, which had important results on the qualities of the materials of which these substances were composed.

There was a natural tendency for the molecule to assume a coiled-up shape. On the other hand, there was a tendency for the molecules to undergo a lateral attraction between the outstretched chains, and therefore there was the balance of these two forces to consider. If the temperature of the system was raised, the molecule tended to coil up; if it was lowered, the interchange forces came into operation and tended to allow the molecules to go to each other. It was on this fundamental basis that the behaviour of these substances depended, and it was on this basis that one could attempt to build molecule structures to fulfil a particular purpose.

Dr. Melville then considered in detail the behaviour of rubber, plastic materials and synthetic fibres, and finally referred to a fibre which, although not yet commercial, was extremely interesting scientifically, because it bore a very close analogy to animal muscle. In animal muscle the main feature was that a chemical reaction occurred within the muscle or very near to it, and as a result of that chemical action mechanical work could be obtained. It was possible to produce fibres which behaved in rather a similar way.

In conclusion, he said that in the attempts that were being made to try to approach this problem of the design of new materials on a logical basis, there were clearly certain simple principles which had to be adhered to in the design of these molecules. The knowledge which was available about the way in which molecules interacted on each other was still incomplete, but it was growing very rapidly, and as a result it seemed that it would not be very long before these molecules could be designed to fulfil a particular role in a very exact way. It was the beginning of a new science and a new technology, and he thought there was every hope that in the future progress would be even more rapid than it had been in the past.

A vote of thanks to Dr. Melville was proposed by Sir Noel Ashbridge and seconded by Dr. Willis Jackson.

Aircraft Cables

A NEW British Standard, E.24 : 1957, specifies requirements for aircraft cables having an insulation of p.v.c. compound and glass braid with a protective covering of nylon. Provision is also made for a range of cables with an outer covering of metal braid.

These "Nyvin" type cables are suitable for use in aircraft circuits in which the voltage between conductors, between the conductor and metal braid surrounding it, and between a conductor and the aircraft structure does not exceed 600 V r.m.s. and in which the frequency does not exceed 1,600 c/s. They are suitable for use where, in continuous service, no combination of ambient temperature and conductor current produces a stabilised conductor temperature in excess of 90 deg C.

The cables are suitable for fixed wiring in aircraft at temperatures down to −75 deg C, but should not be subjected to severe flexing at temperatures below −30 deg C. They do not support combustion and they may be used in areas where ester-based fluids are present.

The Standard specifies the requirements for materials used in the construction of the cables; other requirements deal with dimensions, identification, packing and labelling. Details are also given of type tests, production routine and production quality tests. Copies are obtainable from the British Standards Institution, price 7s 6d.

Two further Standards in the "aircraft" series, B.S. SP.73-75 : 1958, specify the materials, dimensions and finish for steel wire ferrules and associated assembly wires for use with braided rubber cords complying with the requirements of British Standards F.16 and F.51. The Standards contain four diagrams to be read in conjunction with tabulated data on dimensions and code lettering, and an appendix provides a table for converting inch dimensions to their approximate metric equivalents. These Standards are published in one document, price 3s.

Three-Phase Electric Arc Furnaces

Supply Voltage and Current Variations Produced by a 60 Ton Unit

Authors' summary of their paper entitled "Voltage and Current Variations Produced by a 60 ton 3-phase Electric Arc Furnace" which was presented at a joint meeting of the Utilisation and Supply Sections of the Institution of Electrical Engineers yesterday (Thursday) and will be published in Part A of the Proceedings of the Institution

By B. C. ROBINSON, M.Sc., Ph.D., M.I.E.E.,* and A. I. WINDER*

ELECTRIC arc furnaces are being used on an increasing scale for the production of steel. The development of larger units is rendering their use more economical. These furnaces do, however, present difficulties to the supply engineer, to whom they form a valuable and concentrated load. The two principal troubles, which have been mentioned in various technical papers on the subject, are abnormal voltages and flickering of lights connected to the same supply.

A new, and at that time the largest arc furnace in the country, was commissioned at Stocksbridge, near Sheffield, at the end of 1954 and it was felt desirable to investigate its effect on the supply system before installing any further similar plants. The general construction of the furnace follows the usual pattern, and consists of a large steel crucible, lined with refractory bricks, with an inside diameter of about 16ft. The lid is of similar construction and is slightly domed. The power for the furnace is obtained from a 15 MVA transformer with a variable output voltage of 90 to 325 V. This is connected to three carbon electrodes, each 20in in diameter, which pass through holes in the lid. The furnace is charged by swinging the lid to one side, and dropping the scrap metal into the crucible from a large hopper or bucket with a removable bottom.

The furnace "transformer" consists of two transformers in series to facilitate the arrangement of the on-load tap-changing equipment. It is supplied at 11 kV from a substation which was connected to a temporary tee on the 66 kV system (Fig. 1).

When the furnace is first switched on, after recharging, the arcing between the electrodes and the charge is very irregular owing to the cold heterogeneous nature of the scrap metal. Initially, the electrodes bore down into the charge as the metal beneath them melts. The sides of the holes thus produced may then collapse, causing a temporary short circuit of an arc. Alternatively, the automatic control gear for the electrodes may overrun and extinguish an arc by withdrawing an electrode too far. This will cause the transformer to operate on two phases. During the initial melting period it is usual to commence with a fairly high electrode or arc voltage and then gradually increase it to its maximum in order to obtain as much heat as possible to melt the charge. When this is completed, the voltage is again reduced, as less energy is required to keep the charge molten, while the refining and alloying processes are carried out. If a large melt is required, a second charge of scrap metal may be added to the furnace contents after the first has melted.

Two series of tests were made to obtain information about the operating conditions of the plant. The principal records taken were continuous measurements of the voltage and current in all three phases of the 11 kV supply, which was chosen as being more convenient than

* C. A. Parsons & Co., Ltd.

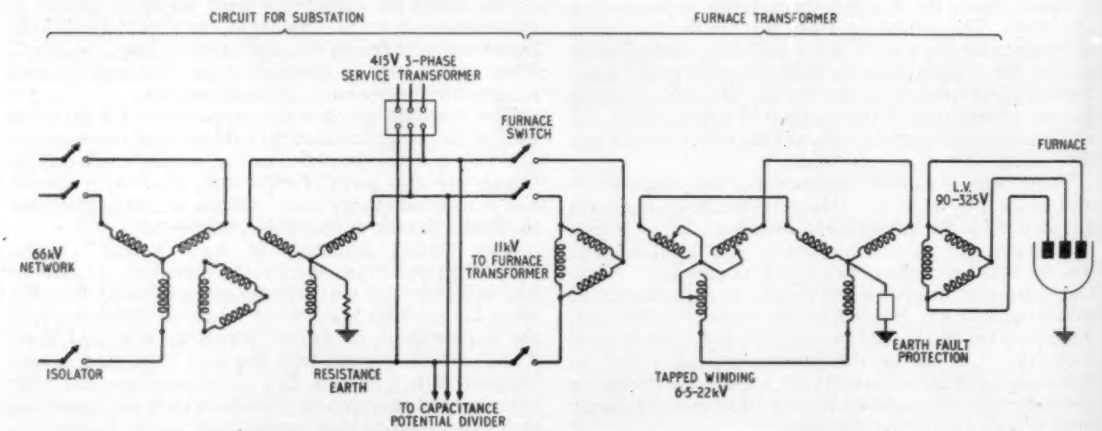


Fig. 1.—Circuit diagram for substation and arc furnace during tests

the 66 kV system and any disturbance produced by the furnace would be more noticeable here than at the higher voltage. The voltages were recorded on a four-beam cathode-ray oscillograph, using a film moving continuously at speeds of about 3in and 4ft per minute. The oscillograph deflections were obtained from capacitance potential dividers connected between each of the three phases and earth. In addition, the fourth tube was used to record the current in one of the phases. These records showed that there was a definite correspondence between the current and voltage fluctuations, indicating that the latter were probably due to the impedance drop in the supply network and in the substation transformer. The higher speed oscillograms indicated that voltage variations from about 75 to 143 per cent of the normal 11 kV open-circuit voltage occurred, though their duration was only a half or one cycle in some cases. Further records of the current in all three phases were taken on a recording ammeter (Fig. 2). A theoretical analysis given in the paper assumes a rectangular waveform for the arc voltage in the furnace. This indicates that the excess voltages can probably be accounted for by the non-sinusoidal waveform produced by the arcs.

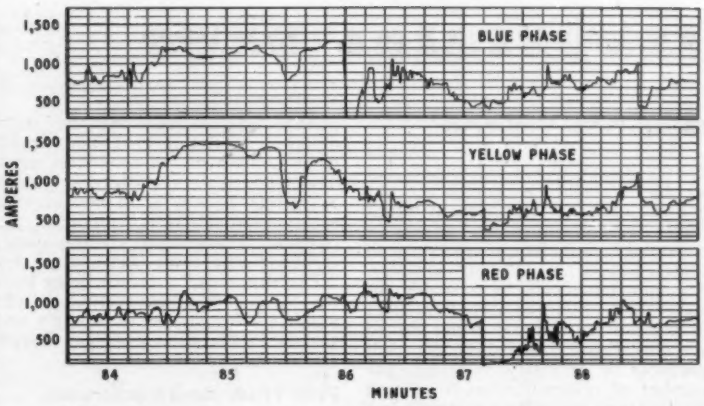


Fig. 2.—Current variations on 11 kV three-phase supply to arc furnace transformer

The second series of measurements were records of the arc voltage to provide data for the theoretical investigations. These took the form of a low-speed oscillogram with a film speed of 4ft per minute during the first hour of a melt, showing the voltage between the furnace electrode clamps and an electrode embedded in the furnace lining which provided a reasonably conducting path from the charge to the furnace casing. These records showed that short circuits lasting several cycles, due to small pieces of metal collapsing on the electrode, were quite common during the initial melting stage.

In addition, high-speed oscillograms were taken showing the voltage waveform and typical examples showing its irregular nature are reproduced in Fig. 3. Oscillogram (a) shows the approximately rectangular waveform obtained under steady arcing conditions. Record (c) appears to be roughly half rectangular and half sinusoidal, which might be due to the arc striking in one direction only, i.e. when the charge is cold. Oscillogram (e) shows the extinction of an arc through a short circuit occurring between the electrode and the charge. The residual voltage after the short circuit will be partly due to the reactive drop in the electrode itself.

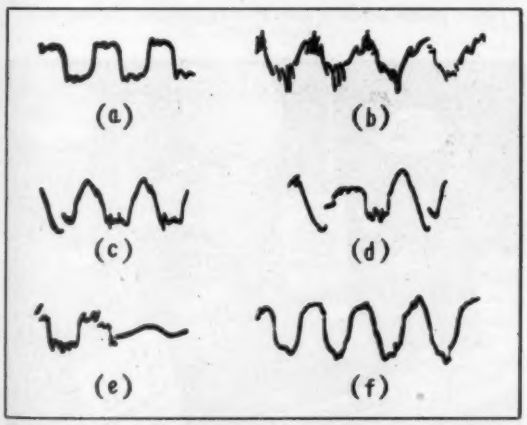


Fig. 3.—Typical arc voltage waveforms between electrode clamps and electrode buried in furnace lining

Calculation of the various system impedances indicated that about 17 per cent of the amplitude of the voltage fluctuations measured on the 11 kV system would be reproduced on the 66 kV network. In practice, the authors found that they could detect the start-up of the furnace when they were about two miles away by watching for flickering of the lights. This did not appear to be detected by the residents.

Since all the voltages concerned were linked with the main transformer fluxes, it is not necessary to provide special reinforcement of the transformer end turns as is done for lightning surges.

X-Ray Cable Terminations

THE latest addition to the series of British Standards which is being prepared for medical and industrial X-ray equipment is B.S. 2928 : 1957 (price 4s 6d). It concerns shockproof high-voltage cable terminations and their corresponding receptacles for operation at 55 kV peak for use in X-ray equipment. Detailed drawings standardise dimensions to ensure interchangeability and safe and efficient operation; materials are not specified.

The type of terminal specified has three contact pins, and the Standard lays down the manner of connecting the pins and sockets to the filament or filaments of X-ray tubes, and specifies appropriate markings. Guidance is given on a procedure for gauging the accuracy of the sockets. High-voltage rating and contact rating are specified, and there are detailed descriptions of the manner of taking samples for test, the testing procedure and the appropriate testing equipment.

The foreword states that at present there are slight dimensional differences between the cable terminations and receptacles made by the various British and American manufacturers. Certain of these products may not comply strictly with all of the dimensions and tolerances laid down in this Standard, but in the majority of instances it will be found that they are for all practical purposes interchangeable. The Standard is, therefore, primarily intended for application in new designs, and its general adoption by manufacturers will ultimately achieve a dimensional uniformity and strict interchangeability of this size of cable termination.

INDUSTRIAL NEWS

Atomic Power Conference

The United Kingdom Atomic Energy Authority has announced that it is to hold a conference at Harwell on 11th June next, at which recent developments in nuclear reactor technology will be discussed with representatives of British industry. Accommodation will be available for about two hundred representatives from industry. Because of the limited accommodation available it will probably be necessary to restrict the number of representatives from each firm. Requests for further details and for reservations should be made to the Director (Industrial Liaison Office), Building 329, Atomic Energy Research Establishment, Harwell, nr. Didcot, Berks., not later than 15th March.

Pumps for Hunterston

Simon-Carves, Ltd., has placed an order with G. & J. Weir, Ltd., for twenty feed pumps for the Hunterston nuclear power station now being constructed for the South of Scotland Electricity Board. The order includes main and auxiliary pumps for both the high- and low-pressure circuits. They will supply the water required for the steam raising units.

Eight high-pressure electrofeeders of the five-stage ring section type will each have an output of 447,600 lb/hr, at 800 lb/sq in, and two auxiliary high-pressure pumps will each discharge 57,250 lb/hr, at 772 lb/sq in. The main low-pressure pumps are also eight in number to discharge 658,300 lb/hr, each at 323 lb/sq in. The two auxiliary low-pressure pumps will each discharge 85,000 lb/hr at 264 lb/sq in. The main pumps are to be fitted with Weir relay-operated automatic by-pass valves to protect the pump in light-load operation.

British Signs at Brussels Exhibition

The main signs for the British Industries Pavilion at the Brussels Exhibition which opens in April have been built by Pearce Signs, Ltd., at its New Cross factory. The lettering, which is mounted on a Belgian red metal panel 65ft long and 5ft high, is the chief feature on the main entrance elevation and identifies the Pavilion designed for the Federation of British Industries by Mr. Edward D. Mills, F.R.I.B.A., F.R.S.A. The letters are in "Embassy" construction, having black all-metal returns, bevelled outlines in white and white "Perspex" faces. The letters are 3ft high and the sign reads "British Industry." The lettering is internally illuminated by double outline Pearce fluorescent white tubing, operating at 60 mA. Transformers and all electrical gear are concealed behind the background panels and the whole sign has been designed to enable it to be shipped from London in self-contained units. The work is to the order of James Kilpatrick & Son, Ltd., who are the main electrical contractors for the pavilion. Pearce Signs are also manufacturing the three large signs for "The Britannia," a tavern being built for Messrs. Whitbread & Co., Ltd., within the British area at Brussels, and a number of other signs for British exhibitors.

Free Trade Area Conference

A European Industrial Conference will be held at Church House, Westminster, London, on 19th, 20th and 21st February. It will bring together industrialists and trades union leaders from fifteen European countries for a discussion of the economic problems resulting from the proposed Free Trade Area. The Conference, which will be opened by the Chancellor of the Exchequer, is being sponsored by the United Kingdom Council of the European Movement.

Government Zinc Stockpile

In accordance with the announcement of 2nd August, 1957, and subsequent announcements, the Board of Trade has been selling zinc from the stockpile at the rate of about 3,000 tons a month. It has now decided that in view of the state of the zinc market no further zinc will be offered for sale for the time being. An announcement will be made when it is decided to resume sales.

Voltage Handbook

The 1957-58 edition of "Electricity Undertakings of the World" (the "Red Book") is now available from Benn Bros., Ltd., 154, Fleet Street, London, E.C.4, price 30s, plus 2s postage and packing. In this, the sixty-seventh of the series, brief details are given of the reorganisation which recently took place under the Electricity Act, 1957, although the particulars included regarding Area Boards and power stations are unaffected by these changes.

The importance of nuclear power developments has justified a departure from tradition and information relating to nuclear plant to be installed by the Atomic Energy Authority in the near future and immediately projected stations is included. Details of electricity authorities overseas follow the same form as in the preceding edition and further entries, including 30 new towns in the United States, combine to make this edition the most comprehensive yet published. The number of pages has been increased to 664.

Information from Henley's

After an interval of about seven years W. T. Henley's Telegraph Works Co., Ltd. (95, Aldwych, London, W.C.2), have produced a new edition of their "General Information" handbook. It first appeared in 1920 and this is the tenth edition. The handbook is of pocket size (7¼in by 4½in) and consists of 153 pages containing a great deal of data on wires and cables, as well as notes on the company and its products.

After an introductory section on copper wires and conductors the handbook gives notes and tabulated figures relating to various classes of cables in various situations, e.g., direct-in-ground, in ducts and in air. Aluminium-conductor cables and overhead line conductors receive attention and much other relevant information is included in the publication.

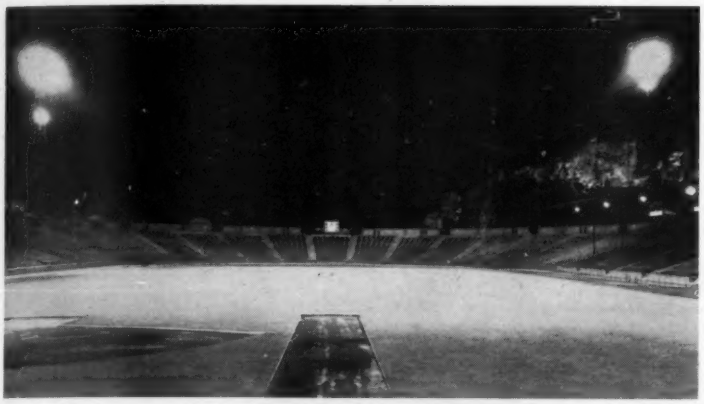
Nuclear Reactor for Western Cape ?

The Universities of Cape Town and Stellenbosch plan to establish an experimental nuclear reactor in the Western Cape. The reactor, costing about £350,000, would be the main apparatus in a central institute for nuclear research.

Space Heating Window Display

The accompanying picture shows a display of Hotpoint space heating appliances by Troon Service Centre,

Topical window display of space heating appliances by the Troon Service Centre



"Mazda" floodlighting at the Soo Kun Poo Stadium, Hong Kong

Ayrshire Area (manager, Mr. A. E. Roots) of the South of Scotland Electricity Board, which was the winning display in the area in a recent contest for the best display of these appliances by Electricity Boards.

P.O. Engineering Workers' Pay

The Post Office Engineering Union has announced pay increases awarded to 50,000 staff by the Civil Service Arbitration Tribunal. Consequential pay increases for the remaining 25,000 covered by the Union will also be made. The total cost will approximate to £3½ million. Nearly twenty grades in the engineering, supplies, motor transport and factories departments will be covered. The increases range from 7s to 23s 6d on the maximum provincial rates for the main grades and are back-dated to July, 1956.

Trade with Chile

Accompanying the 18th January issue of the "Fortnightly Review" of the Bank of London & South America, Ltd., is an outline of the import and export procedure to be followed by traders in Chile under current regulations. Among other matters it deals with "permitted" imports and exports, prior deposits, currency exchange arrangements, and the free trade areas of the country.

Floodlighting for Hong Kong Stadium

A large new "Mazda" floodlighting scheme has been installed in the Soo Kun Poo Stadium, Hong Kong, controlled by the Public Works Department of the Crown Colony. Four towers with lighting grids were erected at a mean height of 174ft above the level of the playing field, and as the stadium itself lies in a valley with cliffs on one side, the actual towers vary in height from 148ft to 68ft and are designed by the manufacturers, Tubewrights, Ltd., to withstand winds up to 120 m.p.h. Each lighting grid carries 36 M.25 floodlights, each mounting a 1,500 W filament M.25 lamp, and a lower lighting grid on each tower carries further M.25 floodlights for the terraces, perimeter roads and car parks. B.I.C.C. cables were used throughout and the total installation cost was £18,000. The contractors were the joint agents of the A.E.I. Lamp & Lighting Co., Ltd., Inniss & Riddle (China), Ltd., and Arnold & Co., Ltd. The scheme was designed by engineers of the A.E.I. Lamp & Lighting Co., Ltd.

Work Study Film

Benefits from modern work study techniques are the subject of a film made by the British Productivity Council called "The Whole Works." The film shows how a large engineering firm, employing about 4,000 people, embarked on a complete reorganisation scheme to secure higher efficiency in cost, production, development and quality control. It was made at the Edmonton factories of British Oxygen Engineering, Ltd., and British Oxygen Gases, Ltd. (Equipment Division). The film can be borrowed from the Central Film Library, Government Building, Bromyard Avenue, Acton, London, W.3.

"Thermodare" Floor Heating

At the request of the Leeds City Architect's Department, and with the co-operation of Concrete Northern, Ltd., a demonstration was recently carried out to show the ease with which a "Thermodare" heating element could be replaced in their system of floor heating.

A standard 23ft Bison floor beam was used and a 1ft length of "Thermodare" floor troughing was fixed at either end. A 42ft length of the blue grade cable was then installed from the trough section at one end to that at the opposite end around a 4½in former and back to the original trough. This was then screeded in with a normal sand-cement mixture to the standard depth of 2¾in, and left to set for approximately 30 hours.

The wire element was withdrawn from the embedded p.v.c. sheathing and was then cleaned with petrol and wiped with a swab soaked in silicone polish. The element was then loosely coiled and one end bent back for approximately ¼in to form a round nose. It was then fed back into the p.v.c. tube to the far end of the beam around the 4½in bend and back again to the original trough with no difficulty, and under normal hand pressure. Its ease of movement in and out of the p.v.c. tube was then tested by several of the visitors.

The complete time of operation from the initial removal of the element wire to its full replacement was approximately ten minutes.

Remote Control Equipment for Kariba Scheme

The contract for the manufacture and installation of remote control equipment for the Kariba hydro-electric scheme on the Zambesi River has been awarded to Standard Telephones & Cables, Ltd., London. The value of the contract, which has been awarded by the Federal Power Board of Rhodesia and Nyasaland, is about £250,000 and it includes direct wire control equipment at the main Kariba power stations, as well as at a number of substations. S.T.C. remote control equipment was also provided for another large-scale African project, the Owen Falls hydro-electric power scheme in Uganda.

Rhodesia and Nyasaland Broadcasting Corporation

On 1st February the Broadcasting Corporation of the Federation of Rhodesia and Nyasaland came into being. The new Corporation has its headquarters in Salisbury and the responsibility for running the Federation's Broadcasting Services is now in the hands of a board of governors, headed by the chairman, Sir Robert Hudson. The director-general of the Corporation is Mr. J. McClurg, recently of the South African Broadcasting Corporation, and there are three controllers in charge of the English and African services and of administration. The chief engineer is Mr. J. M. Reeves, who was previously broadcasting engineer to the Northern Rhodesia Government.

Sell's Building Trades List

The 1958 edition of "Sell's Building Trades List" contains over 40,000 names, addresses and telephone numbers of builders and contractors

ELECTRIC IRONS

Next week's issue will contain an illustrated survey of domestic electric irons with tabulated particulars of type, loading, weight, finish, price, purchase tax and special features. The following survey (14th March issue) will cover kettles and coffee percolators.

and builders' merchants. New sections deal with contractors' plant, quarry products and plastics and over 100 new trade headings (including electrical) have been introduced. The trade marks and brands section has been completely revised. There is also a list of associations, federations and other organisations concerned with the building trade. The directory is published by Business Dictionaries, Ltd., St. Dunstans House, 133-137, Fetter Lane, Fleet Street, London, E.C.4, price 30s.

Vacuum Cleaners for the R.A.F.

Hoover, Ltd., has been awarded a contract to supply 7,000 of its cylinder type vacuum cleaners to the R.A.F. for use in married quarters. Delivery has already begun from the company's Scottish factory, Hoover (Electric Motors), Ltd., Cambuslang, Lanarkshire, where the cleaners are made, to the R.A.F. at its depot at Milton, near Abingdon, Berks.

Brazil's Electrical Imports

In 1956 Brazil imported electrical goods worth £16·4 million, the main sources of supply being the United States (£6·5 million), Belgium (£2·1 million), Western Germany (£1·8 million), the United Kingdom (£1·8 million) and France (£0·7 million). The value of the imports from the United Kingdom represented an increase of nearly £1 million over the figure for 1955. The leading items imported in 1956 and the United Kingdom share are shown in the above table.

Product	Total $ (000)	U.K. Share $ (000)
Generators	3,478	2,785
Generator sets with i.c. engines	3,664	69
Motors	1,694	127
Transformers	3,159	156
Rectifiers and distribution panels	4,627	344
Radio receiving equip. and parts	1,549	116
Telephone equipment and parts	7,417	2,433
Receiving valves and cathode ray tubes	3,348	—
Cables	1,288	366
Regulating and distribution equipment	3,308	143
Condensers	1,133	46
Water turbines	2,590	—

Crystal Palace Television Tower

A new sound film in colour entitled "The Phœnix Tower" shows the construction of the B.B.C.'s Crystal Palace television tower. The film, which runs for 40 minutes, has been produced for British Insulated Callender's Construction Co., Ltd., 30, Leicester Square, London, W.C.2, from whom it may be borrowed.

Railway Abstracts

The Institution of Civil Engineers and the British Transport Commission publish jointly, each month, their own "Railway Engineering Abstracts," which are free to members of the Institution and can be purchased from the Institution by non-members. The Abstracts summarise articles on all the latest developments and techniques in railway engineering, whether civil, mechanical, or electrical, from some forty international publications.

By using the Universal Decimal Classification system, the staff at the Institution are able to provide abstracts of articles which have been published over the last twelve years. Thus the engineer can be informed of the publication, and the date of articles on subjects as diverse as "The Construction of New Railway Lines in South Africa" and "The Experimental Use of Television in Railway Operation."

Met.-Vick. Apprentices' Register

During the past fifty years or so a vast number of men and women have been trained by the Metropolitan-Vickers Electrical Co. and its predecessors. The names of 13,652 of these are included in the fourth edition of the "Register of ex-Apprentices and ex-Trainees" of the company, and these represent only 70 per cent of those who were eligible for inclusion.

In most cases a brief biography is given and this time those trained at the company's Germiston, Motherwell and Sheffield works have been added. Many more illustrations are included; there are again chronological and geographical indexes (with a map); and there are other interesting features. The Register is a handsome and very useful production.

Hotel Guide

The thirteenth edition of "Hotels and Restaurants in Great Britain," published by the British Hotels and Restaurants Association, 88, Brook Street, London, W.1, contains details of hotels, licensed and unlicensed, and of licensed restaurants in Great Britain, Ireland and overseas. The main section gives full particulars of each establishment, and each entry is accompanied by an illustration. There is also a series of road maps, a railway map of the United Kingdom and a map of the London area. Other useful information includes mileage tables, main-route diagrams and details of ferry services. The price of the guide is 3s 6d (4s 6d post free).

Morphy-Richards Campaign

Morphy-Richards, Ltd., are commencing a comprehensive spring publicity campaign on 7th March which will continue until 29th March. The theme of this sales promotion scheme will be "Bless the bride with Britain's finest home appliances—Morphy-Richards." In addition to items on commercial television and Press advertising, a wide selection of "wedding" and traditional display material for dealers will be available from wholesalers, and a nation-wide window display competition is to be held in which cash prizes will be awarded.

Display material available for the Morphy-Richards spring advertising campaign

Ten Years' Generation Progress

We find that some confusion has been caused by the inscriptions for the two illustrations, Figs. 2 and 3, on page 200 of our 31st January issue. One is a Babcock & Wilcox cyclone furnace used for the firing of large boilers, while the other shows the inside of a high pressure boiler drum equipped with Babcock cyclone steam separators, the object of which is to separate moisture from the steam before this passes over to the superheater. The use of the term "cyclone" for both of these pieces of equipment is no doubt responsible for the confusion and the text references to them certainly give the impression that they are identical.

British Railways Diesel Locomotive Order

The British Transport Commission has placed an order with British Railways workshops at Swindon for the construction of thirty main-line 2,000 h.p. diesel-hydraulic locomotives for use in the Western Region. These will be additional to the three locomotives of the same type at present under construction at Swindon Works. Contracts for the locomotive power equipments have been placed by British Railways Western Region with Brush Traction, Ltd., Loughborough (for the supply of the "Maybach" diesel engines), and with J. Stone &

Co. (Deptford), Ltd., London (for the "Mekydro" transmissions). A contract for the supply of the electric control equipments has been placed with British Brown Boveri, Ltd., London.

Clean Air Conference Report

The National Society for Clean Air (formerly the National Smoke Abatement Society) has now published in book form the proceedings at the Society's 1957 conference held at Hastings in October last. Copies are available from the Society at Palace Chambers, Bridge Street, London, S.W.1, price 12s 6d.

Price Reductions

Texas Instruments, Ltd., has announced reductions in the prices of its silicon transistors.

South African Association's New Address

The headquarters of the British Manufacturers' and Representatives' Association, Ltd., in South Africa are now at 513-517, Empire Building, corner of Kruis and Market Streets, P.O. Box 3264, Johannesburg.

Hospital Equipment Exhibition

The first International Hospital Equipment and Medical Services Exhibition will be held at Olympia, London, from 5th to 10th May next. The opening ceremony will be performed by the Minister of Health.

Speeding Up Railway Electrification

A new concrete mixing unit which can produce concrete continuously as it moves along the railway tracks has been working on a section of the line to be electrified near Crewe. It will be used as part of the special electrification work trains which have been developed to erect supporting steelwork for the overhead conductor wires on the London Midland Region's main line electrification project covering the lines between Euston, Birmingham, Liverpool and Manchester.

The concrete mixing unit (a B.I.C.C. machine mounted on railway wagons) carries its own supply of cement in bulk and is supplied with sand and gravel from 50-ton hopper wagons, which are coupled to the unit, and with water from a water carrying vehicle coupled to the opposite end of the unit. The sand and gravel are fed through to the mixing unit by means of a system of conveyor belts driven electrically from a generator van also attached to the train.

This new concrete mixing unit can be used in conjunction with other electrification work trains to erect the steel masts for the overhead equipment in a continuous operation as the trains pass along the track. Trains can plant a mile of masts on one side of the track in a daily period of six hours. The full erection train consists of three sections: the auger borer unit, the mast planting unit, and the concrete mixing unit.

New rail-mounted continuous concrete mixing unit being demonstrated by British Railways (London Midland Region) near Crewe

Manchester Electronics Exhibition

The annual electronics exhibition and convention, organised by the Northern Division of the Institution of Electronics, will be held from 10th to 16th July next at the Manchester College of Science and Technology. The exhibition will consist of a manufacturers' section and a scientific and industrial research section. The convention will include a series of lectures and film shows. Admission will be free. Further particulars can be obtained from the hon. exhibition organiser, Mr. W. Birtwistle, 78, Shaw Road, Rochdale, Lancs.

Trade Announcements

Goring Kerr, Ltd., Gerrards Cross, announces changes of sales and service arrangements. In the North West, Instruments & Controls (J. L. Record), Ltd., of Sandiway Place, Manchester Road, Altrincham, Ches., will continue to act as sole sales representatives for the metal detection equipment, and in the North East, Murray Swanson, Ltd., of Heriot House, Summerhill Terrace, Newcastle-upon-Tyne, 4, have been appointed to handle metal detection and level control equipment in Cumberland, Northumberland, Westmorland and Durham. A separate level control division has been formed and this will be handled by Mr. J. D. Withington, who has recently joined the staff of Goring Kerr, Ltd. His address is 13, Cambridge Avenue, Great Crosby, Liverpool, 23 (telephone: Great Crosby 7468); he will also be responsible for technical servicing of all Goring Kerr equipment in the North West.

The **Electrical Remote Control Co., Ltd.,** has moved to a new factory at Bush Fair, Tye Green, Harlow New Town, Essex. The factory, which is the first one on the industrial estate, will be also accommodating **Equipment & Services, Ltd.**

James Earthrowl & Co., Ltd., 1, Newman Street, London, W.1, have been appointed sole importers and distributors of Canadian Moffat electric cookers. Mr. H. W. Earthrowl, a director of the distributing organisation, has been associated with Moffats, Ltd., for the past ten years and will continue to act as that company's representative in Europe.

The **Dictaphone Co., Ltd.,** Acton, London, has opened a sales and service office at Düsseldorf.

Warne, Wright & Rowland, Ltd., announce that they have merged the manufacturing activities of their subsidiaries, W. T. French & Son, Ltd., G. & W. Purser, Ltd., Carpenter & Allen, Ltd., and Ladbrook Stampings, Ltd., in one company—**Browning Street Industries, Ltd.,** in their factory at Browning Street, Ladywood, Birmingham, 16. Sales which were previously invoiced by four companies will now be dealt with by four firms, each bearing the name of its predecessor company, less the word "Limited." All buying and administrative functions will be dealt with by Browning Street Industries, Ltd. The executives operating from the factory are Messrs. R. T. Knott (director and general manager), K. A. Clowes (accountant and commercial manager), P. E. Sankey (sales manager) and E. V. J. Burt (works manager).

The address of the Glasgow office of **British Insulated Callender's Construction Co., Ltd.,** is now 110a, Maxwell Avenue, Westerton, Bearsden, Glasgow (telephone: Bearsden 2382/3). An additional exchange line has been connected at Aberdeen branch office of **British Insulated Callender's Cables, Ltd.,** and the new telephone numbers are Aberdeen 53351/2.

Design Centre

The Design Centre, 28, Haymarket, London, S.W.1, will in future stay open on Thursdays until 7 p.m.

Change of Name

In future the Self-Priming Pump & Engineering Co., Ltd., of Trading Estate, Slough, Bucks., will be known as the SPE Co., Ltd., aeronautical, electrical, mechanical and hydraulic engineers. The London office is now at 20-26, Lamb's Conduit Street, W.C.1.

PARLIAMENTARY REPORT

Clean Air Act

The remaining provisions of the Clean Air Act, 1956, which have yet to be brought into operation will come into effect on 1st June in accordance with an Order laid before Parliament last week by the Minister of Housing and Local Government.

The most important of these provisions are those contained in Clause 1 prohibiting the emission of dark smoke, which is defined as smoke as dark as, or darker than shade 2 on the Ringelmann Chart. The ban will apply equally to factories, power stations, shops, offices, houses, and the funnels of ships and railway locomotives.

Other provisions are aimed at reducing the emission of dust and grit. From 1st June all new furnaces installed for burning pulverised fuel, or more than one ton an hour of other solid fuels, will have to be equipped with grit and dust arresting plant approved by the local authority. In the case of other new and existing furnaces, with the exception of small domestic boilers, failure to take all practicable steps to minimise grit and dust emission will be an offence.

Penalties in the Act range up to fines of £100. It is worth recalling that temporary exemptions are given for a period up to seven years from the date of the passing of the Act when the emission of dark smoke is due to the nature of the building or its equipment and not to any failure to maintain the building or equipment; or when it has not been practicable to alter or equip the building with changing its purpose to prevent the emission of dark smoke.

Wages by Cheque

The Wages Bill, a Private Member's Bill introduced by Mr. Page, seeks to amend the Truck Acts which make it illegal for firms to pay manual workers by any other method than by "the current coin of the realm," so that with the agreement of an employee an employer may be able to pay wages by cheque. It would also permit workers employed at a distance from the employer's place of business to be paid by money order or postal order.

Rome Treaty and British Contracts

Sir Lionel Heald asked the President of the Board of Trade whether his attention had been drawn to the uncertain legal situation which arose from the projected implementation of the Rome (Common Market) Treaty by six European countries, and, in particular, to the possible effect of Articles 85 and 88 of that Treaty, in rendering null and void numerous current and future British commercial contracts with any of the six countries.

Sir David Eccles said he was aware that there was uncertainty in commercial and legal circles about the effect of these Articles of the Treaty of Rome and he was making inquiries.

Electronics in Parliament

When the Commons debated the modernisation of their procedure, several members suggested ways in which electronic equipment could help to save time and make work easier for M.P.s, such as automatic vote recording. The various suggestions will be considered by the Select Committee which, with the support of the Government, the House is to set up to consider the procedure of the House and to report what alterations, if any, are needed for the efficient dispatch of business.

The Dounreay Reactor

Mr. R. A. Butler, the acting Prime Minister, informed Mr. Mason that the fast breeder reactor being built at Dounreay was almost complete but there would be a period of several months during which tests would be carried out with equipment and controls before the reactor was brought into use.

Capital for Nationalised Industries

Col. Lancaster asked the Chancellor of the Exchequer what provision he proposed to make for meeting the capital requirements of the nationalised industries after 31st March when the powers to make Exchequer advances expired.

Mr. Maudling, the Paymaster General, said that the Government proposed shortly to introduce a Bill allowing the present powers to be exercised until the end of August, but only within the limit of money already authorised. This would give time to consider the future of this method of financing these industries in the context of the Government's general policies, and to include any necessary provisions in the Finance Bill.

So far, under the terms of the 1956 Finance Act, about £574 million has been advanced to the nationalised industries (electricity, gas, transport and the two airways corporations). The Bill mentioned by the Paymaster General would bridge the gap between the expiry date and the time when new provision could be made in the Finance Bill.

North of Scotland Board Loans

Mr. Malcolm MacMillan asked the Chancellor of the Exchequer to what extent it was the policy of the Government to guarantee loans to the North of Scotland Hydro-Electric Board for the relief of financial difficulties arising out of payments of compensation to objectors to the Board's schemes.

Mr. Heathcoat Amory replied that the payment of compensation in connection with constructional schemes was a purpose for which the Board had powers to borrow. At the present time the borrowing of the Board was not financed by market loans with Treasury guarantee but by Exchequer advance under Section 42 of the Finance Act, 1956.

Mr. MacMillan said the Board was already pleading financial difficulties and refusing for that reason to supply its first priority statutory customers in the outlying areas. One of the causes of those difficulties was the princely handouts of compensation to people like the salmon fishery owners.

Mr. Amory said that any policy questions would be taken up by the Secretary of State for Scotland. Payment of compensation must, of course, be in connection with the constructional schemes.

Nuclear Energy in Europe

Sir James Hutchison asked the acting Prime Minister whether it had now been finally decided that this country was to become a member of the European Nuclear Energy Agency.

Mr. Butler replied that the United Kingdom was a member of the Agency, as were all the other member countries of the O.E.E.C. The Agency came into being on 1st February. Questioned further, he said the relationship between the Agency and Euratom was as follows: the Agency statute provided that it should be established in close collaboration with Euratom, whose members were also members of the Agency.

Asked by Mr. H. Hynd whether we were members of Euratom, Mr. Butler said he could not enlarge upon his answer without notice.

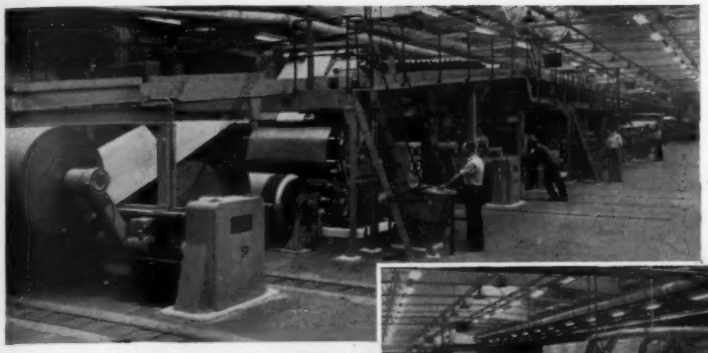
Sir James Hutchison asked what was the extent of this country's commitment to Eurochemic, the joint undertaking for the chemical processing of irradiated fuel.

Mr. Butler said the United Kingdom had indicated its willingness to provide the undertaking with technical assistance and equipment on suitable terms.

Unemployment in Radio and Lamp Industries

Replying to Mr. Hunter, the Minister of Labour, Mr. Iain Macleod said that on 9th December, 1957, the total numbers registered as unemployed were 1,520 in the radio apparatus and gramophone industry and 306 in the radio valve and electric lamp industry. Preliminary indications suggested that there had been a substantial increase in unemployment in January and he would let Mr. Hunter have the figures shortly.

Corrugated Board Manufacture



Above: Langston-Masson 85in corrugated board unit showing entry end. Right: Take-off end of corrugated board machine

IMPROVED MACHINE WITH ELECTRONICALLY CONTROLLED DRIVE

AT their New Hythe works, near Maidstone, Kent, which is one of the largest corrugated board factories in Europe, Reed Corrugated Cases, Ltd., have recently installed a new machine built by Masson Scott & Co., Ltd., Wimbledon, under licence from the Samuel M. Langston Co. of America. The machine incorporates many improvements compared with its American counterpart and a high degree of electronic control. It is 287ft long and will produce corrugated board 85in wide at speeds up to 650ft/min.

One of the main features of the machine is the ability to change the size of the finished boards at the cut-off end without stopping the machine. Either single or double faced corrugated boards can be produced.

The first two sections of the machine, the single facers, are similar except that one section produces finer corrugations than the other. The paper to form the corrugations and one facer paper are brought together at the single facer. After corrugation, adhesive is applied by a roller to the peaks of the corrugation and the facer paper is pressed against the corrugations. At the double facer, which is the next section of the machine, facer paper is applied to the other side of the corrugations. The completed continuous board passes over a 44ft steam heated plate to dry, followed by a 44ft cooling section. The board is then sheared and chopped to size.

Altering Size of Cut Board

As already mentioned, the size of the finished cut board can be altered in about 25 seconds without stopping the machine. This is carried out by pressing a single control button resulting in the following cycle of operations.

The speed of the double facer is reduced or increased to 200ft/min and the rotary shear severs the board by turning through one revolution with a plug stop. Immediately the board is severed, a 20 h.p. differential gear box motor incorporated in the double facer lineshaft reduces the speed of the board at the double facer to 30ft/min. The board which has been sheared continues at 200ft/min and as soon as it clears the slitting units the pre-selected new slitting positions are automatically rotated into place under power control before the slowly advancing new board has reached them. The cut off units change to their new pre-selected sheet lengths and the double facer returns to 200ft/min. The operator may then accelerate the machine manually to normal speed. The speed of the single facer is not altered during the change-over period and any build-up of single faced corrugated board is accommodated on the reservoir conveyor.

Electric Drives

Each single facer is operated by a 50 h.p. main drive motor and a 5 h.p. adhesive roll drive. These motors are fed from a Ward-Leonard set driven by an a.c. induction motor. The drives have constant torque characteristics and regenerative braking is provided. The speed range is equivalent to a board speed of 30 to 650ft/min. Below 65ft/min the speed is stabilised by the introduction of a generator series field control. The adhesive roll motor has an additional slope speed control with biasing features. This enables the speed of the adhesive roll to be increased or decreased with respect to the speed of the board by constant ratio throughout the range.

The double and single facer sections are electrically similar except that the double facer section is driven by a 125 h.p. motor which also drives the slitter and cut-off units. Owing to the very large speed range required for the delivery section, a separate Ward-Leonard set is used which, by means of a tachometer generator driven from the double facer main motor, causes these motors to alter speed with reference to the double facer.

The Electrical Department of the Group Engineering Division of the Reed Paper Group were, with the manufacturers (Printing & Paper Drives, Ltd.), responsible for the design of the electronically controlled drive.

MANUFACTURING PROGRESS IN 1957

Ferguson Pailin, Ltd.

AMONG the noteworthy contracts completed during 1957 by Ferguson Pailin, Ltd., were 132 kV and 33 kV installations for the North of Scotland Hydro-Electric Board at Kintore and a 275 kV supergrid substation at Penwortham, and 132 kV extensions at Bangor, Connah's Quay, Ellesmere Port and Legacy for the Central Electricity Authority. Indoor 33 kV metalclad switchboards were installed for the North Western Electricity Board at Salwick and Royton and for the Yorkshire Electricity Board at Attercliffe and Hibaldstow. In the 6·6 kV and 11 kV distribution switchgear field large numbers of units were supplied to Area Boards and industrial consumers.

Orders placed with the company during the year also covered a wide range including 275 kV extensions at Penwortham and a 132 kV hall type air-blast switching station at Aberthaw, similar to that successfully pioneered in 1953 at Carmarthen Bay. Extensions to the 132 kV substations at Crewe involving also 25 kV switchgear will give supplies to British Railways for their electrification scheme in that area. Two new 132 kV substations are to be constructed for the South of Scotland Electricity Board at Bainsford and Carntyne.

The 22 and 33 kV distribution systems of the Area Boards will be reinforced by major installations at Barrow, Chesterfield, Finchley, Hull, Liverpool and Staines, the majority of these substations being equipped with the type VLP9 indoor metalclad unit. Expansion by the steel companies has resulted in large orders from the Appleby-Frodingham Steel Co. and Richard Thomas & Baldwins.

Outstanding overseas contracts completed and commissioned during the year included 11 kV switchboards for 350 and 500 MVA ratings of single and duplicate busbar design for the Government of Kuwait. These were required for the extension of the main distribution system in that country. Further large orders for 11 kV switchgear included two contracts for a number in excess of 120 units for the Government of Ceylon, consisting of 11 kV, 250 MVA single-busbar substation equipment for twelve substations in the Southern Ring and also for three major substations in Colombo. A quantity of type ROP32 single-bank outdoor circuit-breakers, of 33 kV, 750 MVA rating, was supplied to the Madras Electricity Department for the Basin Bridge substation.

33 kV switchgear at Hibaldstow

Deliveries to New Zealand and South Africa figured prominently in activities of the year. Type VTB5 duplicate busbar units for 11 kV, 350 MVA service were supplied to the Christchurch (New Zealand) Municipal Electricity Department, for their Brighton substation, together with control room equipment. An order was received for forty-two triple-bank indoor cellular circuit-breakers for 40 kV, 1,000 MVA, 600 A service for the South African Electricity Supply Commission and the company is in the course of supplying a stock order for thirty-six similar breakers to the Commission.

The volume of miscellaneous business with Commonwealth territories, Near and Middle East countries and South America has been maintained.

Transistor Specifications

AT an informal meeting of the I.E.E. Radio and Communication Section Mr. F. F. Roberts gave a talk entitled "An Inquiry into the Specification of Transistors." In his introduction he pointed out that, as compared with thermionic valves, transistors were becoming mass-produced articles and their inherent limitations and performance in a variety of circuits were better understood at a much earlier stage of development. This gave more scope for fruitful consultation between the parties that would enable manufacturers to produce units suitable for particular applications and users to engineer circuits with known margins of safety and reliability in essential features.

In most specifications for transistors of controlled quality consideration should be given to the following points:

(i) The ambient temperature and that of the junction to be allowed during operation in service and during acceptance testing; germanium and silicon devices required separate consideration.

(ii) Low-voltage reverse-bias cut-off current.

(iii) Maximum voltage as limited by thermal runaway, avalanche breakdown, punch-through and leakage; the operational circuit configuration might greatly influence the test to be called for.

(iv) Current-gain for a specified range of currents.

(v) Bottoming or saturation voltage for specified currents.

(vi) Some test for base resistance.

(vii) Frequency response; common-base and common-emitter configurations; and finite generator and load impedances.

(viii) Collector capacitance or some related parameter of importance in addition to (vii) in neutralised circuits.

(ix) Switching speed, if this could not be covered by a suitable form of (vii).

(x) Reverse-biased emitter characteristics, as required for Class B amplifier and switching circuit applications.

(xi) Noise figure at audio or higher frequency.

(xii) Life-testing and general reliability.

Long-Distance Radio Propagation

Proceedings of I.E.E. Symposium

By A. W. COLE*

A SYMPOSIUM on long-distance propagation above 30 Mc/s organised by the Institution of Electrical Engineers and held on 28th January dealt with that type of radio propagation popularly known as " scatter." The papers presented at the symposium did not reveal any startling new knowledge; nevertheless they recorded a very considerable effort on the part of British scientists and engineers and it was gratifying to find that progress and initiative in this field is far greater than is commonly thought. Much of the work followed on that initiated in the United States, but there was substantial evidence that scientists in this country have been aware of the possibilities for at least as long as, if not longer than, our American friends.

The practical use of scatter transmission has been largely stimulated by defence requirements in the United States, firstly, by the need for independent, reliable and secure communications to distant oversea bases, leading to the development of the ionospheric scatter system, and secondly, by the need for communication systems over difficult terrain, particularly in the far north in connection with radar warning chains.

Freedom from Interference

It was originally considered that these long-distance ionospheric scatter systems would be free from interference and interception and although this view is now subject to qualification, ionospheric scatter does offer an advantage in this respect, provided due regard is paid to the selection of frequencies. Over distances of up to about 1,300 miles, and using frequencies between 30 and 70 Mc/s, reliable communication can be obtained under conditions which would not at present be possible by other means except by a far more expensive and perhaps vulnerable cable system.

By virtue of the long transmission path and the possibilities of transmission over more than one path simultaneously (giving rise to multiple reception of a given signal element), high attenuation and interference from signals reflected from meteor trails, the ionospheric scatter system is essentially narrow-band. The intelligence which can be transmitted is usually limited to telegraphy; up to 16 channels can usually be transmitted by means of time-division multiplex, each channel carrying one teleprinter. On some of the shorter systems, that is in the neighbourhood of 700 to 1,000 miles, it is also possible to transmit low-grade speech.

The second requirement has given rise to the use of tropospheric scatter, which is suitable for communication over distances of roughly between 100 and 300 miles; this can provide a system with a much wider bandwidth, capable of providing transmission for a large number of simultaneous telephone channels. In some circumstances it may also be suitable for transmission of television programmes. While ionospheric scatter is normally likely to prove most useful for military purposes, tropospheric scatter may well prove a boon in many parts of the world where the cost of normal means of communication would be prohibitive or where it may be impracticable. Communication over stretches of sea where a submarine cable cannot be justified, or over difficult desert country are examples.

While general performance and quality of communication are likely to be below the high standard set for the normal type of microwave radio system or cable, it is likely to be adequate for most purposes and will undoubtedly improve as a result of continuing development.

It is probable that frequency spectrum restrictions in the microwave band will limit development of these systems in the more densely populated parts of the world, except perhaps for military purposes, but in less advanced countries the potential is very great.

The frequency used does not appear to be a matter of great importance and at present both experimental and production equipment is being made available in bands where the systems technique is already available for other purposes. As an example, one of the bands likely to come into common use is that between 750 and 1,000 Mc/s, part of which band is already allocated for television, and for which manufacturers have already developed suitable transmitters.

Experiments have been conducted at frequencies as low as 200 Mc/s and up to frequencies of several thousand Mc/s. Many years are likely to elapse before the propagation possibilities of the various frequency bands have been thoroughly investigated. The economics as affecting equipment and aerials have not yet received much study and it is difficult at this stage to say which frequency bands will in the end prove most suitable for this sort of work. It is probable that for the next few years practical systems are likely to be installed mainly at about 1,000 Mc/s and at about 2,000 Mc/s.

At the symposium itself most of the papers presented dealt with propagation aspects and it was a pity that no one was able to present a paper dealing with systems aspects as such. Apart from the opening speakers, and a few of the authors, the general proceedings in the lecture theatre could only be described as dull. It is questionable whether authors should attempt to deal with details in their papers when they only have a short period allocated to them; a general chat on the subject, high-lighting one or two interesting points, is a far better approach.

Gibraltar to U.K. Transmissions

The morning session of the meeting mainly dealt with papers on the results of ionospheric scatter transmissions between Gibraltar and the United Kingdom, which work was originally organised by the Admiralty and the Marconi Company. This work is of great interest in that it involved the collaboration of a good many bodies in this country, and the table on the following page (extracted from the paper " Survey of the Gibraltar-United Kingdom Ionospheric Scatter Measurements " by Kitchen and Millington, Reprint No. 2516, January, 1958) indicates the scope of this very successful operation.

From the point of view of technical interest it was a pity that there was no record of the work carried out in

* Marconi's Wireless Telegraph Co., Ltd.

CONTRIBUTING ORGANISATIONS, GIBRALTAR TO U.K. SCATTER MEASUREMENTS

Organisation	Location	Position relative to Gibraltar		Type of measurements
		Distance	Bearing	
Admiralty	(a) Scarborough ... (b) Portsmouth ... (c) Various	n.m. 1,300 1,050 1,000 (approx.)	deg 08 10 Various	(a) Assessment of telegraphic systems performance (b) Field-strength measurements using mobile equipments (c) Radiation patterns (d) Investigation of back scatter via the F-region
Marconi's Wireless Telegraph Co., Ltd. (under contract to Admiralty)	(a) Great Baddow ... (b) East Hanningfield, Nr. Chelmsford, Essex	1,100	11	(a) Assessment of telegraphic systems performance, including diversity operation (b) Field-strength measurements (c) Assessment of aerial-system requirements (d) Investigation of interference sources (e) Investigation of back scatter via the F-region
Post Office	Widley, Oxford ...	1,100	09	Measurements of aerial-system performance
D.S.I.R.	Slough, Bucks ...	1,100	10	(a) Field-strength measurements (b) Measurement of angles of arrival (c) Investigation of signal bursts due to meteors (d) Investigation of the influence of F-region effects
Ministry of Supply ...	Christchurch, Hants	1,030	09	(a) Assessment of telegraphic systems performance, including diversity techniques (b) Field-strength measurements
Air Ministry	Marlow, Bucks ...	1,100	10	Field-strength measurements
Cavendish Laboratory	Cambridge	1,150	10	Correlation measurements of instantaneous signal amplitudes at spaced aerials

Canada on the JANET system. Whereas the normal ionospheric scatter system requires transmitters of somewhere between 20 kilowatts and 100 kilowatts, the JANET system operates with low power of the order of about 1 kilowatt. This is because the system only operates by means of reflections from meteor bursts, the receivers monitoring the field strength, and as soon as the high-level burst is received, transmission is started up in both directions at very high speed and discontinued as soon as the meteor burst has passed. While this system involves elaborate storing facilities in that the telegraph intelligence must be continuously stored until it is wanted for the high speed transmission, it could prove to be economically better than the normal brute force method of ionospheric scatter transmission, where the low-level scattered signal is used for transmission and the high-level bursts from meteor trails do not contribute to the efficiency of the circuit.

Tropospheric Propagation

The afternoon and evening sessions dealt mainly with tropospheric propagation and were more varied than in the morning as they recorded the work of a greater number of individual teams. In two cases the papers recorded experience gained on test systems set up by industry, one by the G.E.C. and one by Marconi's. The system set up by the G.E.C. works between Start Point (B.B.C. Transmitting Station) and Wembley, and the Marconi one between Great Bromley, near Clacton, and various stations in the north of England. The latter tests have been carried out almost continuously since May, 1956.

The paper by Angell, Foot, Lucas and Thompson is of particular interest in dealing with the ratio of the constant amplitude component to the random component of the received field, and will be of considerable help in further analysis of this type of system.

Dr. Smith-Rose, opening the discussion on the afternoon session, said that the papers presented were all of great value internationally and that the opening paper, an historical one by Isted, was of great interest. Dr. Smith-Rose also cited the opening of commercial systems as long ago as about 1930.

There was some doubt as to the mechanism involved in tropospheric or "over-the-horizon" propagation and Dr. Saxton in particular said he did not think that measurements being taken at the present time were likely to lead to a complete understanding of the mechanism. In introducing the evening session of the symposium Dr. Saxton made further comments on this issue.

The effect of aircraft passing through the beam producing beat effects and momentary changes in amplitude of the received signals was noted by more than one author. At one time it was thought that the operation of tropospheric terminals near busy airports would be very difficult but this view can probably be modified if the circuit is well engineered.

An interesting paper by Joy gives details of fundamental work which was carried out by the late Dr. E. C. S. Megaw in 1949 when the Admiralty sponsored trials in the North Sea, showing considerable foresight on the part of Dr. Megaw.

As commented earlier, the picture of U.K. activity in this field would have been more comprehensive if a paper had been introduced on the practical systems aspects. At least one British manufacturer has brought equipment to the production stage and is in a position to supply complete tropospheric scatter systems.

It is to be hoped that at a not too distant date papers will be available describing the practical results obtained on communication systems of this type and thus amplify the picture already built up by papers which deal mainly with theoretical and purely propagation aspects of the subject.

Asbestos-Covered Conductors

IN a recently published revision of B.S. 1497 dealing with impregnated-asbestos-covered copper conductors the Standard has been divided into two parts, which have been published separately. Part 1 deals with round wire and Part 2 with rectangular conductors. Provision is now made for two classes of covering on rectangular conductors, one of which is the same as that specified in the 1948 edition, the other being thinner.

Changes have been made in the method of determining the increase in dimensions due to the covering and in the electric strength test. The bending test for rectangular conductors is now on the basis of a mandrel diameter eight times the bare dimension of the strip for all sizes, and a description is given of an improved apparatus for making this test.

The price of Part 1 is 4s 6d and of Part 2 5s. Copies may be obtained from the Publications Department, British Standards Institution, 2, Park Street, London, W.1.

Last year the Aluminum Company of Canada, Ltd., installed the fifth and sixth 150,000 h.p. units at Kemano, British Columbia. The photograph shows part of the transmission line from the underground power-house crossing the mountains to the Kitimat smelter 49 miles away

[Photos by courtesy of Aluminum Company of Canada, Ltd.

ADDITIONAL 1½ MILLION H.P. OF PLANT CAPACITY IN 1957

Power Supply in Canada

CONSTRUCTION of hydro-electric plants in Canada continued to accelerate during 1957 as a result of increasing power demands. The annual survey conducted by the Water Resources Branch of the Department of Northern Affairs and National Resources shows that the total of 1,501,560 h.p. of new capacity added during the year represents the second highest annual increase to date. Other schemes under construction are expected to add about 2,200,000 h.p. during 1958 and more than 4,300,000 h.p. in the succeeding few years. In addition, there are several sites with large potential capacities, which are being investigated and on which it is probable that development will be undertaken within a few years. The total installed capacity of water-power plants in Canada is now listed at 19,871,008 h.p. which, however, represents less than 28 per cent of total resources.

In addition to hydro-electric developments, the building of new thermal plants and extensions was increasing in some areas.

Interior of the Kemano power-house, which has been excavated from solid rock

In British Columbia the 607,500 h.p. of new capacity installed during the year was the highest among the provinces. A number of large developments are being investigated, including one by the British Columbia Power Commission for providing up to 1,900,000 h.p. by diverting water from the Chilko to the Homathko Rivers. In the thermal power field, the Commission has installed the first two simple cycle units at its Georgia gas turbine plant in Vancouver and two regenerative cycle units are now being added. The British Columbia Electric Co., Ltd., is also constructing a gas turbine plant, at Port Mann, where the installation will consist of four 32,500 h.p. units. A large steam station is planned for Ioco, where the first of six 210,000 h.p. sets is scheduled for operation early in 1961.

Last year over 200 miles of 345 kV transmission line was brought into service by the company to provide a second circuit from Bridge River to Vancouver, as well as linking the Wahleach plant, at the higher voltage, to the Ingledow terminal station near Vancouver.

The Aluminum Company of Canada, Ltd., installed the fifth and sixth units, each of 150,000 h.p., in its Kemano plant, bringing the total capacity to 900,000 h.p. It is expected that a seventh unit, also of 150,000 h.p., will be installed early this year.

Demands for power throughout past years have resulted in an intensive construction programme by the Hydro-Electric Power Commission of Ontario, as a result of which a substantial growth in power requirements has been met successfully. Major construction work during 1957 included developments at the St. Lawrence power project, Sir Adam Beck-Niagara No. 2 generating station, and six projects in north-western Ontario.

Thermal Power Developments

The St. Lawrence project, a joint development of the International Rapids Section of the St. Lawrence River, was begun in August, 1954. On the Canadian side, five of the sixteen units are scheduled for service this year; the rest will be placed in service during the period 1959-1960.

The St. Lawrence project is the last major hydro-electric development within economic transmission distance of large load centres in the southern Ontario system, and even in north-western Ontario there are now distinct advantages to be derived from the development of thermal resources. Last autumn the Commission undertook to build three new thermal stations, one at Fort William and two in the Toronto-Hamilton area. Meanwhile work was well under way for the enlargement of the present Richard L. Hearn generating station in Toronto to 1,200 MW, or three times its present size. Studies are being continued in conjunction with Atomic Energy of Canada, Ltd., and

other interested agencies with regard to the development of a large-scale reactor for the production of energy from nuclear resources.

The Province of Quebec continued its extensive hydro-electric power activities with a net capacity increase during 1957 of 473,900 h.p., after allowing for the dismantling of 10,100 h.p. of capacity. In addition, new capacity under construction will add about 900,000 h.p. this year and more than 2,700,000 h.p. in later years.

The Quebec Hydro-Electric Commission completed the installation of the fourth and fifth units in its Bersimis I development some 300 miles north-east of Montreal, raising the installed capacity of the plant to 750,000 h.p. Each unit is rated at 150,000 h.p. and operates under a head of 875ft. The ultimate capacity of the underground power-house will be 1,200,000 h.p. in eight units. At Bersimis II, about 23 miles downstream, the power-house will have a total installation of 855,000 h.p. in five units under a head of 375ft.

At the Beauharnois development on the St. Lawrence River, some 30 miles from Montreal, the Commission proceeded with the construction of the third and final section of the power-house which will contain eleven units, each of 73,700 h.p. under a head of 80ft. Initial operation of this section is expected late this year and the completion of the entire plant, with a total installed capacity of 2,235,000 h.p., in 1960.

The Aluminum Company of Canada, Ltd., proceeded with construction of its development on the Peribonka River at Chutes des Passes, which will contain five 200,000 h.p. units to be operated under a head of 625ft. The first unit is expected to commence service in the autumn of 1959.

The Shawinigan Water & Power Company made good progress on the construction of its 330,000 h.p. development on the St. Maurice River at Rapide Beaumont.

In Alberta, Calgary Power, Ltd., is adding to its Wabamun steam station a second 66,000 kW unit which is scheduled for operation in October.

The Manitoba Hydro-Electric Board is proceeding with the construction of its development on the Nelson River at Grand Rapid, about 400 miles north of Winnipeg, to supply power for the International Nickel Company mining development at Moak, Mystery and Thompson Lakes. The initial installation is four 42,000 h.p. propeller-type turbines operating under a normal head of 50ft. At the Board's steam station at Brandon the first two 33,000 kW units commenced operation in December. At the Selkirk thermal station the foundations are being laid for the main building which will house two 66,000 kW units scheduled for initial operation in the latter part of 1959.

The New Brunswick Electric Power Commission is constructing a 50,000 kW steam plant at Saint John which is expected to be completed in 1959. In Nova Scotia, plant extensions are being carried out by the Nova Scotia Light & Power Co., Ltd., to its Water Street steam station at Halifax and by the Seaboard Power Corporation, Ltd., to its steam plant at Sydney.

The British Newfoundland Corporation, Ltd., is considering a hydro-electric development at Bay d'Espoir in the central part of Newfoundland where 350,000 h.p. may be developed under a head of about 530ft.

Microwave Valve Convention

MODERN radar was made possible by the development of new "microwave" valves, working at much higher frequencies than any previously available. There have been continuous developments in the application of microwave valves to communications during the past few years. The use of microwaves has enabled new trunk telephone and radio systems to be developed and installed, without adding further congestion to an overcrowded frequency spectrum. One particularly interesting aspect has been in the development of scatter transmission systems. In these, high frequency radio energy is beamed into the sky and scattered in the upper atmosphere. Some of this radio energy is returned to earth, where is can be picked up by a suitable receiver.

With the ether becoming more and more crowded with radio stations, scientists are turning their attention away from wireless to metallic conductors. With the aid of microwaves of the shortest wavelength, small tubes laid in the ground can transmit thousands of telephone conversations at once. By these developments the gap between radio waves and light waves is being slowly closed.

The heart of these new applications of microwaves is the thermionic valve, which research has developed into a variety of devices. These newer valves have become so important, and their development is so rapid, that regular international conferences have to be held to enable scientists in every part of the world to exchange ideas. The latest conference is the International Convention on Microwave Valves which the Institution of Electrical Engineers is organising in London from 19th to 23rd May next. The importance of this meeting is best underlined by the fact that among the countries from which papers have been submitted are France, Germany, Holland, Japan and the United States, and that in addition inquiries have already been received from 17 countries including Australia, Canada, Ceylon, Egypt, India, Sweden and Switzerland.

Further information about the Convention can be obtained from the Secretary, Institution of Electrical Engineers, Savoy Place, London, W.C.2.

Nuclear Reactor Precautions

IN a written answer on Monday, Sir Ian Horobin, Parliamentary Secretary, Ministry of Power, announced that the Government intended to introduce legislation to ensure, by a system of licensing and inspection, that nuclear reactors on land were made effectively subject to control in the interest of public safety. All owners of such reactors would be subject to the same duty as the Atomic Energy Authority of preventing damage to property or personal injury from radioactive contamination. They would, therefore, be liable to pay compensation for such damage even if it was due to an unavoidable accident, except of course to the extent that the claimant injured had been guilty of contributory negligence.

In order to make this provision effective a reactor owner would be required to insure his liability or to show that he was holding adequate liquid assets. In these circumstances, the Government had decided that it would be right to put some limit on the amount of compensation which reactor owners might have to pay in respect of any one incident. They proposed, therefore, to include in the legislation a provision fixing this limit at £5 million in respect of each installation. The insurance market had informed the Government that they were ready to provide the necessary cover. The liability of the Atomic Energy Authority would be unaffected. [The Authority does not insure, but is liable to pay full compensation without limit for any harm it might cause by ionising radiations.]

Problems of reactors in ships, submarines and aircraft required further study, having regard particularly to the international aspects.

In an explanatory statement the Ministry of Power stated that the figure of £5 million was a purely arbitrary one. It was not believed there was any real danger of damage up to anything like this figure. For example, the cost of the damage caused by the Windscale mishap was unlikely to have exceeded £60,000 to £70,000 for milk, and a relatively small amount for other claims. The present proposals related only to damage resulting from radioactive contamination since the liability of a reactor owner for damages due to other causes, and the rights of injured parties to claim against him, would not be affected by the proposed legislation. Preparatory work on the proposed Bill was going ahead as rapidly as possible, but it could not be expected that the draft legislation would be ready during the current session of Parliament.

NEW ELECTRICAL EQUIPMENT

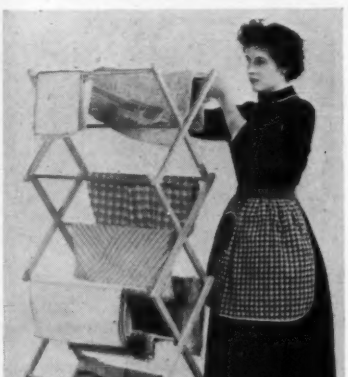
Convector Heater

Following upon the introduction of the 750 W "Creda Calypso" convector heater a few months ago the SIMPLEX ELECTRIC CO., LTD., Creda Works, Blythe Bridge, Staffs., has now produced a 2 kW model. It is fitted with a bi-metal thermal cut-out to ensure safe operation.

Construction is of sheet steel, "Bonderized" and stove enamelled, and the element frame is of corrosion resistant "Zintex." A cream plastic carrying handle is fitted. The convector is 26in high by 24½in wide by 7½in deep and the weight is 18 lb. An orange pilot light indicates when the heater is on and an on/off switch is fitted for two-heat control.

"Creda Calypso" 2 kW convector heater

Hawkins "Hi-Dry" clothes airer



It is claimed that no matter how long the heater is switched on the surface temperature will not exceed 70 deg C. It is available in a range of two-tone colour schemes—cream and red, cream and beige, satin black and cream, pink and grey, and beige and chocolate. The price is £6 18s 4d plus £3 0s 8d purchase tax in the United Kingdom.

Reclamation of Oil Waste

Now available in this country, the Schlegel regenerator, made by Schlegel Brothers, Stuttgart, is being handled by LIQUID SYSTEMS, LTD., Norwich Union House, Wellesley Road, Croydon. Waste oil can be refined in the regenerator by adding a small quantity of a refining agent known as "F.E." to the waste oil in the open regenerator.

The lid is closed and, by means of a hand-pump or compressor, the inside pressure is raised to approximately 36 p.s.i. The electric heating is switched on automatically by the air pressure. The heat so generated will, together with the refining agent, start the soft refining process by which all oxidising products dissolved in the oil are separated. The regenerated oil flows out of the regenerator in an even stream and, when the entire charge has been completely processed, the heating is switched off automatically. The residue remaining after the regenerating process is a dry compressed cake which is easily removed by a scraper.

Schlegel oil regenerator, model M.A.

Two small models, K.A. and M.A., have capacities of 3·3 gal and 9·9 gal, respectively, and larger models are available up to a maximum capacity of 88 gal.

Clothes Dryer and Airer

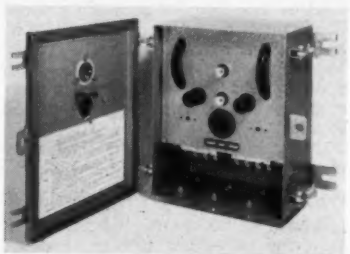
An expanding type electric clothes dryer and airer, claimed to have a capacity equal to 30ft of clothes line, is the latest product to be announced by L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, London, W.C.2. Fully extended, this new "Hi-Dry" rack, constructed of hardwood, reaches to a height of 5ft 4in but measures only 25in by 21in by 8in when folded flat.

The base of the unit contains a 1 kW black heat element and models are available for use on 200/220 or 230/250 V. There is also a removable drip tray and clips are provided for easy stowage of its 9ft of t.r.s. flexible. The price of the unit is £5 10s 10d plus £2 8s 8d purchase tax in the United Kingdom.

Level Controller

An improved capacity-operated switch for high level alarm or control, the "Tektor Major," is announced by FIELDEN ELECTRONICS, LTD., Wythenshawe, Manchester. The switch can be mounted at a maximum distance of 35ft from the electrode in the container. A calibrated knob inside the case, on the front of the chassis, enables the set-point to be easily adjusted. The sensitivity of the controller is better than 1·0 pF under all conditions.

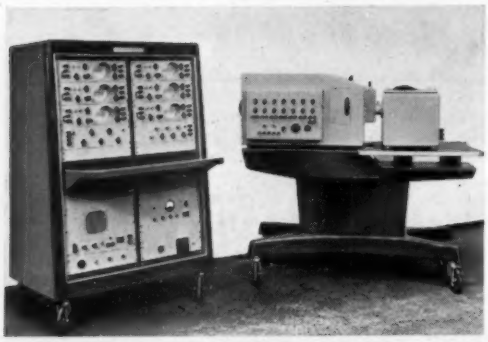
The relay is of the contactor type with one pair of normally open and one pair of normally closed contacts rated at 440 V 5 A a.c. non-inductive. A voltage selector switch is fitted for any supply in the 110-125, 220-250 and 380-440 V ranges, 40-60 c/s. The unit has a sheet metal weatherproof case and fail-to-safety facilities are included.



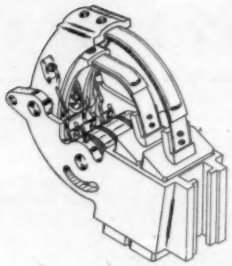
Fielden Electronics "Tektor Major" level controller

Universal Oscillograph

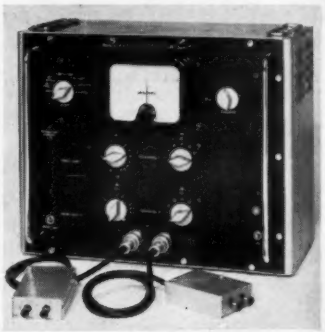
A new type of cathode-ray oscillograph, to provide a multi-channel recording equipment, has been developed by SOUTHERN INSTRUMENTS, Oscillograph Division, Frimley Road, Camberley, Surrey. The 3in diameter recording tubes are separate from the main equipment and are housed in a cabinet to which the camera and optical system are fitted. Monitoring tubes are fitted in the separate amplifier console. Power supplies and driving voltages are supplied to a



Southern Instruments MUR6 oscillograph



Brush holder (Synthetic Carbon & Engineering Co.)



Airmec phase meter

master distribution panel in the recording unit by means of flexible cables from the amplifier console.

Within the recording unit the tubes are mounted in adjustable clamps on a short steel column. This is fixed to a base sliding on rails and enables the tubes to be moved towards or away from the camera lens in a precise manner. Thus, the user can alter the conditions with ease and photograph as many of the tube faces as he needs. Two models are available, providing up to six and twelve channels, respectively, with time marking.

Cathodic Protection

A simple, inexpensive and efficient method of welding copper cable to steel or cast-iron for cathodic protection is the latest development of METAL & PIPELINE ENDURANCE, LTD., Artillery Mansions, Victoria Street, London, S.W.1. The "Mapelweld" process requires no external heat or power source. A flint gun is used to ignite a charge in a graphite mould which is placed over the surfaces to be welded.

Compact Lighting Fitting

A twin 5ft fluorescent lighting fitting requiring only 30in storage space is available from the MIDLAND COIL WINDING CO., LTD., 4, Lancaster Street, Birmingham, 4. Two ½in steel tubes, 20in long, which carry the lampholders and wiring, can be folded back on to the 21in sheet steel case housing the transformer start ballast unit. When the tubes are opened for use, the lamps can be adjusted by rotating the lampholders about the steel tubes, an obvious advantage for shop window lighting. The fitting can be supplied for ceiling suspension or vertical mounting. The list price is £7 10s.

Tandem Brush Holders

A new range of holders for tandem brushes have recently been designed and developed by the SYNTHETIC CARBON & ENGINEERING CO., LTD., Cumberland Road, Stanmore, Middlesex. The basis of the design is to use clock springs pulling by stout wire links on to pressure fingers. In order to get a balanced pull, the outer finger is harnessed to two narrow clock springs and the inner finger to one wider central clock spring. The geometry of the layout is such that the fall-off in pressure of the clock springs is compensated for by an increased leverage on the pressure fingers as the links move forward.

Marine Radar

A new commercial marine radar equipment, the "Escort," announced by the BRITISH THOMSON-HOUSTON CO., LTD., Rugby, makes possible visual appraisal of a situation developing at sea. The equipment can be fitted to the largest ocean-going liners or to trawlers. Several forms of PPI (Plan Position Indicator) presentation can be selected by a switch. In "chart plan" presentation, the centre of the rotating trace (the ship's position) travels across the display with a speed and direction corresponding to the movement of the ship. The display thus has a fixed frame of reference, stationary objects appearing as stationary echoes, while echoes from moving objects draw behind them "tails" which indicate their true course. Relative data cannot easily be extracted from this form of presentation but the "chart plan" generators can be arrested so that the tails will turn to indicate relative courses.

"Vantage point" off-centring ensures that the "chart plan" display remains unaltered for long periods and both "north upwards" and "ship's head upwards" relative displays can be selected. Combined electronic and mechanical bearing markers enable the bearing of echoes to be read from one scale around the PPI tube irrespective of whether the picture is "centred" or "off-centred." The display provides seven ranges from 0-¼ mile to 0-48 miles. The cathode ray tube employed is the preferred 12in size. B.T.H. Type RMS-2 radar equipments can be modified to include the "chart plan" feature.

L.F. Phase Meter

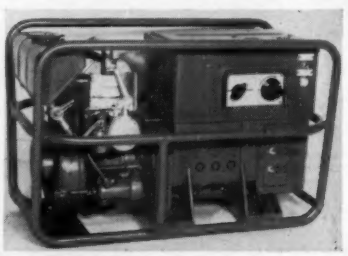
Measurements of gain, attenuation and phase-shift can be made on any four-terminal network operating in the frequency range 20 c/s to 100 kc/s by the Type 206 phase meter made by AIRMEC, LTD., High Wycombe, Bucks.

Phase is indicated directly on a 6in meter having four scales, and gain or loss values are indicated by the difference between two attenuator settings. Input signals are connected to the instrument via two cathode follower probes having input impedances of 12 MΩ.

Measurements are made by adjusting the attenuators in each channel to give standard meter deflection, the phase displacement then being indicated directly on the meter when the "select" switch is turned to "phase." The range of input level on either channel is 1 mV to 1 V and insertion losses and gains of up to 60 dB can therefore be measured.

A.C. and D.C. Generator

For supplying a.c. apparatus as well as for battery charging, AB HAGGLUND & SONER, Ornsköldsvik, Sweden, have developed a generator of 1,200 W output with a transistorised voltage regulator. The set, which was designed to meet military requirements, comprises an alternator for



Hagglund a.c. and d.c. generator

simultaneous d.c. and a.c. output, and a two-stroke petrol engine. The alternator is continuously rated at 70-50 A d.c. at 14-22 V, and also 1·5 kVA, 0·8 p.f., at 230 V, 50 c/s single phase. A simultaneous d.c. and a.c. output of 1,200 W can be obtained. The transistorised regulator ensures an a.c. voltage regulation less than ±5 per cent. With Class "E" insulation, the alternator and engine are designed to withstand tropical and also very cold conditions. Electrical and manual starting is provided.

GENERATION AND DEVELOPMENT

Recovery in Domestic Appliance Sales

A return issued by the Electricity Council shows the number of new appliances sold by Area Boards in England and Wales during the quarter and year ended 31st December last. From the accompanying table, which includes comparative figures for 1956, it will be seen that except for storage water heaters there was a recovery in sales of all the main items of equipment; in two categories—wash boilers and refrigerators—the increases more than made good the previous fall in sales. When assessing the figures, it must be borne in mind that the sales by Area Boards represent only a part of total sales throughout the country.

Sales of New Domestic Appliances by Area Boards with Percentage Increase or Decrease Compared with the Previous Year

Type of Appliance	Quarter Ended 31st December, 1957		Year Ended 31st December			
			1957		1956	
		%		%		%
Cookers	60,829	+ 6·0	230,068	+11·3	206,742	−15·2
Water Heaters:						
Immersion	21,534	+ 3·3	140,476	+ 5·1	133,673	−18·0
Storage	10,076	+ 0·4	41,656	− 1·2	42,173	−32·3
Wash Boilers	19,433	+13·0	80,513	+30·1	61,870	− 2·7
Washing Machines	18,035	+ 5·7	73,545	+ 2·7	71,642	−54·2
Refrigerators	6,384	+36·9	50,030	+55·8	32,111	−40·6

Pinkston Transfer Approved

On 6th February Glasgow Corporation approved without comment a proposal to transfer its Pinkston power station to the South of Scotland Electricity Board. Pinkston supplies the power for the municipal tramway, trolley-bus and underground services.

The main basis of the financial terms which had been proposed for the transference was that the Board would accept responsibility for the future annual payments on the outstanding debt, which at present stands at about £1,750,000. That debt arises from the large-scale modernisation of the power station which has been carried out in recent years, one effect of which has been to standardise frequency and enable surplus energy to be fed into the national grid.

Use of Power Station Ash

It is reported in the *Birmingham Post* that more than 200,000 tons of fly-ash from Carrington power station is to be used as bulk filling in the construction of the Stretford-Eccles by-pass road.

A factory being built at Hams Hall for Thermalite, Ltd., a member of the John Laing group of companies, will eventually utilise about 25 per cent of the station's ash in making cellular concrete building blocks, and is expected to start work this summer. A scheme for a brickworks to make use of the station's ash in producing about 3 million bricks a year has had to be postponed because of the "credit squeeze."

Higher Charges in Belfast

Increases in charges for electricity in Belfast, to take effect after the meter readings for the first survey period this year, have been approved by Belfast City Council. Domestic consumers will pay 6½ per cent more, while at the other end of the scale the rate for industrial lighting will rise by 13½ per cent. Domestic consumers will also get less discount, the reduction for accounts paid within one month being cut from 5 to 2½ per cent. The last increase in charges took place in September, 1956, when there was an all-round increase of 7½ per cent. The main reason given for the revision is the large increase in interest rates.

Rural Supply Delays

At the annual meeting of the Cumberland Development Council reference was made to the delay in supplying electricity to rural areas. Mr. Langton Highton, an industrialist, claimed that people in the Western Lakeland area were suffering hardship. One reason for the slow progress was the selfishness of various public bodies which vigorously opposed the erection of overhead lines carrying electricity to remote areas.

Mr. J. E. Shepherd, sub-area manager, North Western Electricity Board, said that more than 4,600 farms already had an electricity supply and there remained 3,000 to be connected. The Board was anxious to carry out the work, but was encountering slowing down tactics "of weird and various" kinds. At the present rate of progress, it would be ten years before these 3,000 farms could be supplied. As an example of how work was being slowed down, he said that it had taken 12 to 18 months to obtain permission to erect a 28ft pole on Sandale Fell, although there had been no opposition to the B.B.C.'s 500ft mast there.

Glasgow Tramcar Decision

Glasgow Corporation is to abolish its tramcars and replace them by motor-buses. Accepting a recommendation to this effect on 6th February the Corporation also decided to limit its trolley-bus fleet to 200 vehicles.

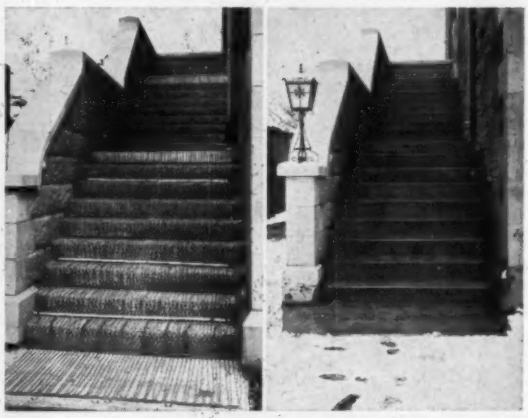
Replying to Councillor G. Reid, who suggested a period of 10 years for the abolition of trams instead of the 15 years that had been proposed, the transport convener, Councillor J. J. M'Crossan, said that the conversion would be carried out as quickly as possible. He pointed out that 300 trams had been scrapped in the city during the past three or four years.

Telephone Charges at Hull

It is recommended by Hull Corporation Telephone Committee that the charge for local calls should remain unchanged at 2d. Reductions in some private hire charges are proposed.

External Stairway Heating

An interesting application of electrical heating cables is shown in the illustrations of an external stairway. The heating system has a total loading of 4·8 kW and comprises 12 "Calidec" FC/400 cables, each 165ft long and rated at 400 W. Control of the system is effected by manual switching or automatically by a weatherproof thermostat mounted outside the building. The stairway was designed by Morton J. H. Cowie, A.R.I.B.A.,



Stairway under construction and (right) completed

A.R.I.A.S., Edinburgh. The heating system was designed by the South of Scotland Electricity Board and installed by Henry A. Tait & Sons, Ltd., electrical engineers and contractors, Edinburgh.

Floor Heating

Colne Town Council has approved a proposal to install electric floor heating in a block of flats at Lob Common. The Council was influenced by the success of a floor warming scheme for flats in Scotland.

OVERSEAS

Victorian Commission's Expanding Activities

The chairman of the Victorian State Electricity Commission, Mr. W. H. Connolly, reports that during the past year more than 175 MW of new generating plant was commissioned and nearly £22 million spent on new capital works. By the middle of this year the Yallourn "D" extension will be almost complete, with two 50 MW sets and four of the six boilers in operation. In the next eleven years the Commission plans to install nearly 1,250 MW of new generating plant in brown-coal power stations in the Latrobe Valley. With regard to water power, work is continuing steadily on the new 90 MW station at Kiewa (due for completion in 1962). Victoria's first power from the Snowy Mountains scheme is expected to be available next year; its share will increase from an estimated 25 MW then to about 200 MW in 1963.

The Commission's steam, diesel and hydro-electric power stations now produce 99 per cent of the State's electricity. In the period covered by the latest report 4,763 million kWh was produced, 7·5 per cent more than in the previous year.

Sales last year rose by 254 million kWh to 3,860 million kWh and a further 29,000 consumers were connected. Revenue from all sources amounted to £36·6 million, there being a net surplus of £406,000 after writing off £2·1 million on new works and allocating £500,000 to reserves. Net investment in fixed capital assets now totals £209 million, after providing £27 million for depreciation. Reserves amount to £9 million.

N.S.W. Power Station Explosion

The Sydney correspondent of *The Times* reports that damage estimated at more than £A100,000 was caused when an explosion shattered a turbo-generator at White Bay power house on 3rd February. When a gauge showed alarming pressure, employees ran for cover just before the explosion. Flying metal damaged a second generator. A fire which broke out was extinguished with foam after half an hour.

An official of the New South Wales Electricity Commission said that the damage from the explosion had reduced the station's capacity by 50,000 kW. It would be nearly two years before full repairs could be made.

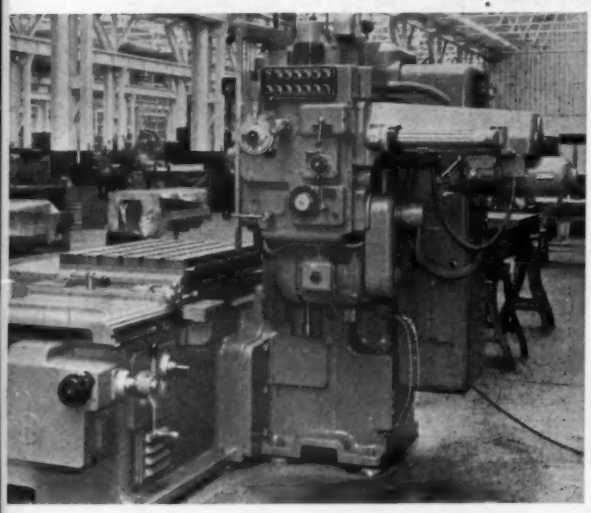
Precision Jigless Boring

THE smallest of the range of DeVlieg "Jigmils," known as the 2B/36 "Spiramatic," is now being manufactured by Alfred Herbert, Ltd., Coventry, under licence from the DeVlieg Machine Co., Detroit, U.S.A. Apart from minor exceptions, it is a copy of the American-made machine, to ensure interchangeability of components. Automatic machine functions enable precision machining to be carried out without special skill or the use of expensive jigs. Large or small production batches, or even "one-off" jobs, can be produced economically.

The positioning of the machine table and of the spindle head in the horizontal and vertical planes is automatic, though a patented sequenced electrical cycle. End-measuring gauges are placed in the measuring troughs on the spindle column and machine table. The pressing of the "auto-position" push-button causes the machine table or spindle head to move in rapid traverse until the end-measuring gauge contacts a limit switch. The over-run is corrected by reversing at a fast feed rate and the resulting smaller over-run is eliminated by a forward slow feed traverse. At the final position a timed reverse slow feed traverse of half the backlash, with a plug stop, releases the end thrust of the feed screw so that the table or spindle head can be locked securely without affecting their accurate location. The plugging relays are made by the Igranic Electric Co., Ltd., and the pneumatic timer by Electro-Methods, Ltd.

Other salient features of the machine include automatic depth control for single or multiple bores and power-operated tool locking. No electronic devices are employed, the control circuits being based on electro-magnetic relays.

Herbert/DeVlieg "Spiramatic Jigmil" and (right) control cabinet with test panel



NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

Monday, 17th February

BRISTOL.—Bristol University Engineering Laboratories, 6 p.m. I.E.E. Western Supply Group. "Mechanical Strength of Power Transformers in Service," by E. T. Norris.

EDINBURGH. — University of Edinburgh, 7.15 p.m. Institute of Physics, Scottish Branch. "The Electronic Computer in Industry," by R. H. Tizard.

IPSWICH. — Electric House, 7.15 p.m. Ipswich and District Electrical Association. "High Quality Sound Reproduction," by A. R. Hawes.

LIVERPOOL.—At the Royal Institution, Colquitt Street, 6.30 p.m. I.E.E. Mersey and North Wales Centre. Discussion of the report on "The Supply and Training of Teachers for Technical Colleges," introduced by Dr. Willis Jackson.

NEWCASTLE-UPON-TYNE. — King's College, 6.15 p.m. I.E.E. North Eastern Radio and Measurements Group. "The Measurement of High Voltages with Indicating or Recording Instruments," by G. W. Bowdler.

PORTSMOUTH. — Portsmouth College of Technology, 7.30 p.m. Institution of Naval Architects and Institute of Marine Engineers. "Nuclear Power for Ship Propulsion," by S. L. Smith.

Tuesday, 18th February

CAMBRIDGE. — Technical College, Collier Road, 6 p.m. I.E.E. East Anglian Sub-Centre. "275 kV Transmission Lines," by J. D. Pierce.

COVENTRY.—Coventry Electricity Sports and Social Club. Coventry Electric Club. "Rectifiers and Transistors," by B. R. Bettridge.

EDINBURGH.—Carlton Hotel, North Bridge, 7 p.m. I.E.E. South East Scotland Sub-Centre. "British Columbia-Vancouver Island 138 kV Submarine Power Cable," by Dr. T. Ingledew, R. M. Fairfield, E. L. Davey, K. S. Brazier and J. N. Gibson.

GLASGOW.—University of Glasgow, 7.15 p.m. Institute of Physics, Scottish Branch. "The Electronic Computer in Industry," by R. H. Tizard.

GREAT YARMOUTH.—Great Yarmouth Technical College, Lichfield Road, 7.30 p.m. Ministry of Works, Great Yarmouth District. "Artificial Lighting for Modern Buildings," by J. B. Harris.

HANLEY.—Victoria Hall, 7.30 p.m. I.E.E. North Staffordshire Sub-Centre. Faraday Lecture. "The Electrification of the British Railways," prepared by the late G. H. Fletcher, delivered by R. Ledger.

LEEDS.—C.E.G.B. Yorkshire Division, 1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Utilisation Group. "Development of Transportable Thermal-Storage Space Heaters," by E. Bates.

LIVERPOOL.—Liverpool Passenger Transport Office, 24, Hatton Garden, 6 p.m. I.E.S. Liverpool Centre. "The Use of Light in Combating Crime," by Det.-Insp. Weeks.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurement and Control Section. "Magnetic Tape for Data Recording," by Dr. C. D. Mee. (To be read by J. F. Doust.)

Conference Room, 4th Floor, Waterloo Bridge House, S.E.1, 5 p.m. Institution of Post Office Electrical Engineers, London Centre. Informal meeting. "Service to the Region—the Work of L.T.R. Power Section," by K. M. Trigwell.

Electrical Association for Women, London Branch. 11 a.m. Annual general meeting in St. Andrew's Hall, Overseas House, St. James, S.W.1. 12.45 p.m. Buffet luncheon in the Hall of India and Pakistan, Overseas House. Speaker, Viscountess Kilmuir (president, E.A.W.).

Great George Street, Westminster, S.W.1, 5.30 p.m. Institution of Civil Engineers. "Jodrell Bank Radio Telescope," by H. C. Husband.

47, Belgrave Square, S.W.1, 5.30 p.m. Institute of Physics, Electronics Group. "Electronic Devices in Telephony," by Dr. J. E. Flood.

MANCHESTER.—Engineers' Club, 6.15 p.m. I.E.E. North Western Measurement and Control Group. "The Breakdown of Transformer Oil under Impulse Voltages," by Dr. R. Hancox and Dr. H. Tropper.

NEWCASTLE-UPON-TYNE. — Crown Hotel, Clayton Street West, 7.30 p.m. I.E.E. Tyneside Branch. "Turbine Supervisory Equipment," by E. D. Kelly.

PETERBOROUGH.—Conference Room, Peterscourt, 7.30 p.m. Institution of Production Engineers, Peterborough Section. "Electric Welding," by J. W. Wright.

PLYMOUTH. — South Western Electricity Board Showrooms, New George Street, 3 p.m. I.E.E. South Western Sub-Centre. "Mechanical Strength of Power Transformers in Service," by E. T. Norris. (Joint meeting with Western Supply Group.)

RUGBY.—Rugby College of Technology and Arts, 6.30 p.m. I.E.E. Rugby Graduate and Student Section. "Electricity in Aircraft," by B. L. Perry.

WORKINGTON. — Workington College of Further Education, 7 p.m. I.E.E. North Eastern Centre. District meeting. "Germanium and Silicon Power Rectifiers," by T. H. Kinman, G. A. Garrick, R. G. Hibberd and A. J. Blundell.

Wednesday, 19th February

BIRKENHEAD.—Birkenhead Technical College, 7 p.m. British Institution of Radio Engineers, Merseyside Section. "Closed-circuit Television," by J. G. M. Downes.

BRISTOL.—The University, 7.15 p.m. I.E.E. Bristol Graduate and Student Section. "Some Problems of Nuclear Power Plant," by B. L. Goodlet.

LEICESTER.—Grand Hotel, 7 p.m. Incorporated Plant Engineers, Leicester Branch. Annual dinner-dance.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Radio and Telecommunication Section. "The Relation Between Picture Size, Viewing Distance and Picture Quality with Special Reference to Colour Television and to Spot-Wobble Techniques," by L. C. Jesty.

At the Institution of Civil Engineers, Great George Street, S.W.1, 5.30 p.m. Institute of Fuel. Melchett Lecture for 1957 on "Nuclear Power Development, Some Experiences of the First Ten Years," by Sir Christopher Hinton.

ROCHESTER.—King's Head Hotel, High Street, 7 p.m. Incorporated Plant Engineers, Kent Branch. "Applications of Photography in Science and Engineering," by J. F. Paddav.

SHEFFIELD.—Grand Hotel, 6.30 p.m. I.E.E. Sheffield Sub-Centre. "Supply Voltage and Current Variations Produced by a 60-ton, 3-phase Arc Furnace," by Dr. B. C. Robinson and A. I. Winder.

Thursday, 20th February

BIRMINGHAM. — A.S.E.E. North West London Branch. Visit to Cadby Hall (afternoon).

BLACKBURN.—Golden Lion Hotel, 7.30 p.m. Incorporated Plant Engineers, Blackburn District. "Nuclear Reactors for Power Production," by J. A. Dixon.

BRISTOL.—Royal Hotel, College Green, 7 p.m. Institute of Metal Finishing, Bristol and South West Branch. Dinner and dance.

CHELMSFORD. — Hoffmann's Social Hall, 7.30 p.m. Chelmsford Engineering Society. "The Development of Industrial Gas Turbines," by G. B. R. Feilden.

GLASGOW.—Elmbank Crescent, 7 p.m. British Institution of Radio Engineers, Scottish Section. "Frequency Response Instrumentation for the Analysis, Design and Production of Servomechanisms," by G. R. Swainston.

GRAVESEND.—Royal Clarendon Hotel, 7.30 p.m. A.S.E.E. Kent Branch. Film show.

INVERNESS.—I.E.E. North Scotland Sub-Centre. District meeting. "Review of Development of Hydro-Generation in Scotland," by H. R. Joyce.

LINCOLN.—Ruston Club, 7.30 p.m. Institution of Production Engineers, Lincoln Section. "The Computer Control of Machine Tools," by M. Monk.

LONDON.—Burlington House, W.1, 4.30 p.m. Royal Society. "Recent Advances in Nuclear Physics," by R. E. Peierls, D. H. Wilkinson and W. E. Burcham.

Caxton Hall, Westminster, S.W.1, 2.30 p.m. Diesel Engineers' and Users' Association. "Engine Evolution: Non-Marine Engines Over a Quarter of a Century," by D. S. D. Williams.

MANCHESTER. — Demonstration Theatre, N.W. Electricity Board, Town Hall, 6 p.m. I.E.S. Manchester Centre. "Lighting at London Airport," by J. G. Holmes.

NOTTINGHAM. — Albert Hall, 7.15 p.m. I.E.E. East Midland Centre. Faraday Lecture on "The Electrification of the British Railways," prepared by the late G. H. Fletcher, delivered by R. Ledger.

SOUTHAMPTON.—Polygon Hotel, 7.15 p.m. Institution of Production Engineers, Southampton Section. "Manufacture of Electric Power Cables," by Dr. Arman.

Friday, 21st February

CARLISLE. — Carlisle Technical College, 7 p.m. I.E.E. North Eastern Centre. District meeting. "Earthing of Low- and Medium-Voltage Distribution Systems and Equipment," by F. Mather.

EDINBURGH.—The University, 7 p.m. British Institution of Radio Engineers, Scottish Section. "Frequency Response Instrumentation for the Analysis, Design and Production of Servomechanisms," by G. R. Swainston.

GLASGOW. — I.E.S. Glasgow Centre. Luncheon meeting.

LONDON.—Savoy Place, W.C.2, 6.30 p.m. I.E.E. London Graduate and Student Section. Conversazione and dance.

Connaught Rooms, W.C.2, 12.45 p.m. Electrical Trades' Commercial Travellers' Association. Annual luncheon.

Connaught Rooms, W.C.2, 7.30 for 8 p.m. Incorporated Plant Engineers. Annual dinner.

SOUTHGATE. — Northmet House, N.14, 3.30 p.m. E.I.B.A. North Metropolitan Branch. Annual general meeting.

STONE.—Crown Hotel, 7 for 7.30 p.m. I.E.E. North Staffordshire Sub-Centre. Annual dinner.

I.E.E. Western Centre

The annual dinner and dance of the Western Centre of the Institution of Electrical Engineers will be held on 14th March at the Seabank Hotel, Porthcawl (7 for 7.30 p.m.). Applications for tickets (£1 5s each) should be made by 21st February to Mr. D. Stephens, hon. assistant secretary, Western Centre, 7, Clovelly Crescent, Llanrumney, Cardiff. Special tickets (7s 6d each), will be issued to enable students and graduates to attend the dance only.

Financial Section

STOCKS and SHARES

WHILE the industrial markets of the Stock Exchange remained quiet and irregular, the prices of Government securities have been edging their way upwards for one week after another until they stand now almost level with, and in some cases above, those ruling before last September's dramatic increase in Bank Rate. For example, the 3 per cent British Electricity stock redeemable 1968–73 (the security issued originally at 100 in compensation for nationalised electricity supply company shares) stood just before that event at about 73, and after dipping in the succeeding weeks to 70, has recovered now to 74. In many opinions, the extent of the recovery has already discounted the moderate Bank Rate reduction which is expected to come before very much longer.

Gilt-edged Yields

On the 3 per cent British Electricity stock mentioned above, and on the Authority's other 3 per cent issue, redeemable 1974–77, the current yields at their respective prices of about 74 and 70 are in the neighbourhood of 4¼ per cent. In both cases the main attraction to a present buyer is of course the very large capital profit assured upon their repayment at 100 within the due dates. Allowing for this, the gross "redemption yields" work out at over 5½ per cent; and since the capital profit is free of tax, the return to a stockholder in the upper income-tax ranges may in effect be equivalent to a rate a great deal larger than that. For a higher current yield the best propositions in the group of British Electricity stocks are the 4¼ per cent issue redeemable 1974–79, quoted at 85½, and the 4¼ per cent stock 1967–69, at 91. Present yields are around 5 per cent.

Price Changes

G.E.C. £1 shares remained depressed by the cut in the interim dividend and by the company's warning about the effect of lower profit margins upon the earnings of the group in the current year, which ends next month. The price was marked down by a further 1s 9d, to 32s 6d. Other electrical engineering shares continued to be unsettled. A.E.I. and English Electric both came back by 1s 3d. Crompton Parkinson and C. A. Parsons were little changed on balance, after being higher. In the cable group, W. T. Henley's lost 1s of the previous week's 3s rise, but B.I.C.C. were well maintained and there were improvements in L.E.W. and Hackbridge Holdings. Among shares with motor-car industry associations, Lucas, S. Smith and Chloride Electric showed improvement. Elliott-Automation were active, and higher, at 12s 6d, while Plessey regained 2s to 57s 6d, and Metal Industries put on 1s, to 27s, following the declaration of an increase in the interim dividend from 3 to 4 per cent.

Falk Stadelmann

The £1 shares of Falk Stadelmann & Co. have been attracting some attention

Price Changes in

Company or Board	Nom. Value	Middle price 10th Feb.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1958 Highest	1958 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	74	+¼	3	3	4 1 0	80	70
Brit. Elec. 1974/77	100	70x.d.	+½	3	3	4 5 9	78½	66
Brit. Elec. 1976/79	100	74½	+½	3½	3½	4 14 0	81½	70
Brit. Elec. 1974/79	100	85½		4½	4½	4 19 6	92½	79½
Overseas Electric Supply								
Calcutta Elec.	£1	16/-		6†	6·8†	8 10 0†	19/-	15/-
East African Power	£1	18/6		7	7½	8 2 3	21/-	19/-
Nigerian Elec.	£1	16/6		10	10	12 2 6	18/6	16/6
Perak Hydro-Elec.	£1	15/-		10	12½	16 13 3	18/-	13/3
Electrical Shares								
Aberdare Cables	5/-	10/6		17½	17½	8 6 9	12/-	9/9
Aerialite	1/-	5/9		48	51½	8 19 3	6/9	4/9
Allen, W. H.	£1	34/6		10	10	5 16 0	47/3	33/6
Anglo-Portuguese Tel.	£1	21/3	+6d	8	8	7 10 6	27/6	20/6
Aron Elec. Ord.	£1	54/-		15	15	5 11 0	60/-	53/6
Assoc. Elec. Ord.	£1	48/9	−1/3	15	15	6 3 0	73/-	48/9
Automatic Tel. & El.	£1	60/9	+9d	15	17	5 11 9	75/-	54/6
Babcock & Wilcox	£1	43/9		15	13‡	5 18 9	82/6	54/9
Bakelite	10/-	20/6	+6d	16	15	7 6 3	24/6	20/9
Baldwin, H. J.	2/-	3/3		20	20	12 6 3	5/-	3/9
Berry's Electric	5/-	6/-		—	10	8 6 9	6/6	5/6
British Aluminium	£1	44/6		12	12	5 7 9	71/3	38/9
Brit. Elec. Traction: Def. Ord. "A"	5/-	21/6	−6d	22½	25	5 16 3	25/-	17/-
B.I. Callender's	£1	42/3		12½	12½	5 18 3	55/-	39/6
B.I. Callender's 6% Pref. ...	£1	20/-		6	6	6 0 0	21/9	19/-
British Tabulating	£1	40/9	+9d	9	10	4 18 3	56/3	37/6
British Thermostat	5/-	21/3	+1/3	25	25	5 17 9	27/6	21/3
British Vac. Cleaner	5/-	5/-		15	10	10 0 0	8/-	5/-
Brook Motors	10/-	35/-		25	25	7 2 9	37/6	30/-
Bulgin, A. F.	1/-	4/9		50	40*	8 8 6	5/6	4/-
Burco Dean	5/-	8/-	−6d	20	22½	9 7 6*	9/4	5/10
Cable & Wireless: Ord.	5/-	10/6		10	10	4 15 3	12/6	9/6
4% Loan	100	93½		4	4	4 5 6	92½	89
Chloride El. Storage "A" ...	£1	57/-	+9d	17½	17½	6 2 9	68/9	55/9
Clarke Chapman	£1	140/-	−5/-	22½	27½	3 18 6	9	5½
Cole, E. K.	5/-	16/3	−3d	17½	17½	5 7 9	23/6	16/6
Cossor, A. C.	5/-	5/-	−3d	Nil	2½	2 10 0	7/3	5/-
Crabtree	10/-	25/3		20	20	7 18 6	26/-	23/3
Crompton Parkinson Ord. ...	5/-	8/9		16	16	6 1 9*	11/9	9/3
De La Rue	5/-	22/9	−1/-	30	35	7 13 9	24/9	16/3
Decca "A"	4/-	23/3		43½	43½	7 10 6	32/3	22/-
Desoutter	5/-	14/-		30	32½	5 16 0*	17/9	13/9
Dewhurst	2/-	7/6		16½	20	5 6 9	7/9	5/9
Dictograph Tel.	2/-	5/3		20	20*	7 12 6	6/3	5/3
Dubilier Condenser	1/-	3/3		30	30	—	5/3	3/-
Duport	5/-	8/3		25	25	7 11 6*	10/6	8/6
E.M.I.	10/-	31/6	−3d	15	15	4 15 3	36/-	23/9
Electrical Components	5/-	7/6		25	12½*	8 6 9	8/-	6/6
Elec. Construction	£1	21/3	−1/3	8½	8½	8 0 0	27/6	21/9
Elliott-Automation	5/-	12/6	+9d	—	10‡	4 0 0	12/6	10/3
Enfield Cable Ord.	£1	11/6	−6d	Nil	Nil	Nil	21/6	12/3
English Electric	£1	46/3	−1/3	12½	14	6 1 0	65/-	47/6
English Electric 3½% Pref. ...	£1	12/3		3½	3½	6 2 6	14/3	11/3
Ericsson Tel.	5/-	19/-	+3d	20†	22†	2 18 0*†	25/-	17/-
Ever Ready	5/-	14/3	−3d	35	37½	6 11 6*	20/-	14/-
Falk Stadelman	£1	37/6	+9d	17½	17½	9 6 9	40/6	35/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

since the report of developments in Northern Ireland, where a new company has been formed, jointly with the American firm of Warren Wire, to produce a wide range of cables. Output from this project will apparently be on a much larger scale than that of the present cable manufacturing members of the group. Dividends of 17½ per cent have been paid by Falk, Stadelmann for each of the past three years, following a long line of 15 per cent distributions. The last published accounts, covering the year to March, 1957, showed a rise in the net profit to £191,000, which represented earnings of about 47 per cent gross on the £635,250 ordinary capital. The shares are quoted at about 37s 6d to yield close on 9½ per cent.

Electrical Investments

Company or Board	Nom. Value	Middle price 10th Feb.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1957 Highest	1957 Lowest
Electrical Shares—continued								
G.E.C. Ord.	£1	32/6	−1/9	14	12½	—	58/9	37/6
G.E.C. 6½% Pref.	£1	21/-		6½	6½	6 3 9	23/6	19/6
General Cables	5/-	12/-		30	24	10 0 0	15/6	11/6
Greenwood & Batley	£1	47/6		17½	17½	7 7 3	51/3	45/3
Hackbridge Holdings	5/-	9/9	+3d	30	20	10 5 0	21/9	11/3
Hackbridge & Hewittic	5/-	11/3		23	20	8 17 9	16/-	10/-
Head Wrightson	5/-	18/9		20	22½	—	24/3	16/6
Heatrae	2/-	4/9	+3d	15	15	6 6 3	4/9	4/-
Henley's	10/-	13/6	−1/-	11½	11½	8 10 3	17/-	11/-
Holophane	5/-	13/3		30	37½	8 9 9*	15/9	10/3
Hoover	5/-	32/6		50	50	7 13 9	44/-	24/9
I.C.I.	£1	39/-	−9d	10	10	5 2 6	46/6	36/3
Intl. Combustion	5/-	20/-		20	22½	5 12 6	30/-	19/3
Johnson & Phillips	£1	17/6		15	10	11 8 6	34/6	18/9
Lancashire Dynamo	£1	32/6		11	11	6 15 3	45/9	33/6
Laurence, Scott	5/-	13/9		15	15	5 9 0	19/9	13/9
Lister, R. A.	£1	24/9	−6d	10	10	8 1 6	33/9	23/3
London Elec. Wire	£1	42/-	+9d	12½	12½	5 19 0	53/9	40/9
Lucas, J.	£1	29/6	+6d	7½	7½	5 1 9	36/6	27/6
Marconi Marine	£1	31/-	+1/-	10	10	6 9 0	37/-	30/-
Marryat & Scott	2/-	10/6		30	35	6 13 3	13/-	8/-
Mather & Platt	£1	45/9	−6d	15	15	6 11 3	63/9	47/-
Metal Industries	£1	27/-	+1/-	Nil	9	6 13 3	30/-	20/3
Midland Elec. Mfg.	£1	47/6		12½	12½	5 5 3	52/6	45/-
Morphy-Richards	4/-	15/-		50	20*	5 6 9	20/-	11/6
Murex	£1	55/9		20	20	7 3 6	79/6	58/3
Newman Ind.	2/-	2/9		10	10	7 5 6	2/11	2/1
Oldham & Son	1/-	2/6		17½	17½	7 0 0	3/-	2/3
Parnall (Yate)	5/-	6/-		12	12	10 0 0	8/9	5/9
Parsons, C. A.	£1	46/6	+3d	8½	7½*‡	—	71/3	45/-
Plessey	10/-	57/6	+2/-	30	30	5 4 3	86/3	60/-
Pye "A" Deferred	5/-	12/-		12½	12½	5 4 3	20/-	12/-
Reyrolle	£1	82/6		16½	17½	4 4 9	110/-	72/-
Rheostatic	4/-	7/9		18½	12½*	6 9 0	10/-	7/-
Richardsons Westgarth	10/-	15/-	+6d	16½	16½	5 11 3*	20/-	13/6
Scottish Cables	4/-	13/3		27½	27½	8 6 0	19/3	13/3
Simon-Carves	5/-	24/3		28½	20*	4 2 6	36/3	23/9
Smith (England), S.	4/-	7/9	+3d	17½	20	5 3 3*	8/-	6/3
Southern Areas	£1	11/3		7½	7½	13 16 9	20/-	11/3
Strand Elec.	5/-	5/9		15	15	13 0 9	8/-	5/9
Sturtevant	5/-	18/-	+3d	15†	15†	4 3 3†	27/-	17/9
Sun Elec.	£1	47/6		25	25	10 10 6	47/6	42/-
Switchgear & Cowans	5/-	9/3	+6d	25	25	—	15/6	9/6
Taylor Tunnicliff	5/-	12/3		15	15	6 2 6	13/9	11/9
T.C.C.	10/-	37/6		25	25	6 13 3	41/3	35/-
T.C. & M.	£1	21/6		8½	8½	7 18 3	31/-	23/6
Telephone Mfg.	5/-	5/3		10	10	9 10 6	8/-	5/3
Telephone Rentals	5/-	10/6	+3d	12½	12½	5 19 0	12/6	9/6
Thompson (John)	5/-	24/-	+6d	25	25	5 4 3	37/-	23/6
Thorn Elec.	5/-	20/9	+3d	15	17½	4 4 3	26/3	16/3
Thornycroft	£1	24/3	−1/-	12½	12½	10 6 3	37/6	21/3
Tube Investments	£1	51/3	−6d	13‡	15	5 17 0	70/-	51/3
Vactric	5/-	14/6		17½	25	8 12 6	23/9	12/9
Veritys	5/-	5/3		12½	12½	11 18 3	9/3	6/9
Walsall Conduits	4/-	12/-	+3d	20	20	6 13 3	15/-	11/-
Ward & Goldstone	5/-	25/-	+6d	35	40	4 0 0*	29/-	18/6
Watford	2/-	6/-		25	25	8 6 9	6/9	5/9
Westinghouse	£1	36/3		18	10*	5 10 3	41/3	28/9
West, Allen	5/-	10/-		15	15	—	13/6	9/6
Wolf Electric	5/-	9/-		20	20	5 11 0*	13/9	8/9

Hoover Dividend

Among the most interesting of coming company results is the Hoover announcement of the final dividend and preliminary profits statement for 1957. Twelve months ago the company reported a fall of about a million in the trading profits, and the dividend remained at the 40 per cent rate to which it was cut, from 70 per cent, the year before. Subsequently an interim statement covering the first half of 1957 reported a recovery to the extent of 16 per cent in sales, in comparison with the corresponding six months of the previous year, while profits (before tax) were estimated to have risen by more than 60 per cent. Prospects for the second half were said to indicate a maintenance of turnover, but increasing pressure on profit margins as a result of higher costs of wages, services and materials. Last time, the full results were made known by the end of February.

R. B. Pullin Report

The appearance of the balance sheet of R. B. Pullin & Co., dated 30th September, 1957, has been greatly altered as a result of the capital issues and of the acquisition of Aldis Brothers and other new developments during the year. Issued ordinary capital has expanded from £175,000 to £377,500. Fixed assets are twice as large as before, and there are large increases in stocks and work and other items, as well as in the cash holding. Trading profits improved in the latest year by approximately 50 per cent, despite the facts that profit margins narrowed, only six months' profits of Aldis Brothers were credited, and the benefit of much of recent capital expenditure is evidently still to come. The dividend is being maintained at a total 20 per cent, on the basis of which the 2s ordinary shares at a price of 6s 6d offer a yield of £6 3s 0d per cent.

Preference Shares

Preference shares on offer recently in fairly large numbers included A.E.I. 4½ per cents, at 15s 1½d, and English Electric 3¾ per cents, at 12s 6d, the yield in each case being approximately 6 per cent. A similar return is shown by Ericsson Telephones "sevens" at 23s 3d, while L.E.W. 7½ per cents at 23s give 6½ per cent on the money. Yields of approximately 6¾ per cent are shown on Aerialite 6 per cent redeemable preference at 17s 9d, Electric Construction 7 per cents at 20s 6d, and Hackbridge Holdings "fives" at 14s 9d. Among loan stocks, Thorn Electrical 5¾ per cent stock, redeemable 1959–64, has been available at 92, to yield 6¼ per cent.

REPORTS and DIVIDENDS

J. H. Fenner & Co. (Holdings), Ltd.—The statement by Mr. C. Bradshaw (chairman), presented at the recent annual meeting of the company, stated that the financial results of the group for the year ended 31st August last were satisfactory. Mr. Bradshaw said that for the main company, J. H. Fenner & Co., Ltd., which was concerned mainly with providing mechanical power transmission equipment, the year had been a good one for trading, but only because of greatly increased turnover. Reviewing the activities of the associated companies, the chairman said that in the case of N.G.N. Electrical, Ltd., which produced high vacuum equipment, the year under review had been spent in development.

Pantiya Tea & Rubber Co., Ltd.—At the end of last year this company acquired the whole of the issued share capital of Walmore Electronics, Ltd., a company which specialises in the electronic component distribution field. The policy of the board is to build up a group of electronic companies, principally concerned with distribution, and to this end, negotiations are in progress to acquire another company.

At an extraordinary meeting held on 7th February, resolutions changing the name of the Pantiya Tea & Rubber Co. to Pantiya Electronics, Ltd., and increasing the capital of the company from £30,000 to £200,000 by the creation of an additional 1,700,000 ordinary shares of 2s each, to rank *pari passu* in all respects with the existing ordinary shares, were duly passed.

Metal Industries, Ltd., has declared an interim dividend of 4 per cent (against 3 per cent).

Increases of Capital

Crompton Parkinson, Ltd.—Increased by £2,750,000, in 5s ordinary shares, beyond the registered capital of £5,950,000.

Desoutter Brothers (Holdings), Ltd.—Increased by £350,000 in 5s "A" non-voting ordinary shares, beyond the registered capital of £700,000.

Robert Hardman, Ltd.—Increased by £20,000 in £1 ordinary shares, beyond the registered capital of £5,000.

New Companies

Webb-Hart, Ltd.—Registered 27th January. Capital £500. Electrical equipment winding specialists, etc. Directors: G. S. Webber, Mrs. Irene J. Webber, A. H. Hart and Mrs. Ellen Hart. Regd. office: 294, High Street, Acton, W.3.

N. & N. Partridge, Ltd.—Registered 24th January. Capital £100. Manufacturers of and dealers in refrigerators, refrigeration plant and all types of electrical appliances, etc. Solicitors: Glaisyer, Porter & Mason, Birmingham.

North Thames Electric Co., Ltd.—Registered 3rd February. Capital £100. Manufacturers, exporters and importers of, dealers in and agents for electrical apparatus and appliances, radio and television apparatus and appliances, etc. Directors: B. Burford and Helene L. Burford. Regd. office: 55, Whitecross Street, E.C.1.

T. & Y., Ltd.—Registered 4th February. Capital £100. To acquire the whole or part of the undertaking of Troughton & Young, Ltd., and to carry on the business of electrical, mechanical, heating, ventilating and general engineers, etc. Solicitors: Slaughter & May, 18, Austin Friars, E.C.2.

A.R.C. Electrical Installation Co., Ltd.—Registered 3rd February. Capital £1,000. Electrical contractors, civil and electrical engineers, etc. Directors: R. Culley and A. V. Culley. Regd. office: 643, Honeypot Lane, Stanmore, Middx.

Horne Electrical Co., Ltd.—Registered 3rd February. Capital £600. Electrical contractors, etc. Directors: K. A. Horne and Phyllis E. Horne. Regd. office: 48, Windmill Street, Gravesend.

Megotapes, Ltd.—Registered 30th January. Capital £1,000. Manufacturing and printing tapes used in the identification of electric cables, etc. Directors: G. K. Moss and C. Boyle. Regd. office: 32, Kennedy Street, Manchester, 2.

Forbes & Seymour, Ltd.—Registered 31st January. Capital £100. Electronic, radio and electrical specialists, etc. Directors: J. A. A. Forbes and E. W. Seymour. Regd. office: 47, Greek Street, W.1.

Landau Electrical Co., Ltd.—Registered 20th January. Capital £100. Electrical, radio, television and refrigeration engineers and contractors, etc. Directors: B. Landau and Mrs. Bluma Landau. Regd. office: 401, Commercial Road, E.1.

Able Engineering Co., Ltd.—Registered 19th December. Capital £1,000. Development engineers and manufacturers of electrical equipment, including transductors, amplifiers, automatic control equipment, etc. Directors: W. J. S. Lyttle and A. C. Lyttle. Regd. office: 6, Singer Street Chambers, Singer Street, London, E.C.2.

Best and May (Sales), Ltd.—Registered 5th February. Capital £100. Manufacturers of and dealers in electrical and engineering products of all kinds, etc. Directors: J. T. May and W. Best. Regd. office: 345/347, Kennington Road, S.E.11.

Viscount Electrical, Ltd.—Registered 5th February. Capital £5,000. Manufacturers and distributors of household and other appliances, etc. Solicitors: William A. Crump & Son, 10-11, Lime Street, E.C.3.

Bat-Ray Co. (X-Ray), Ltd.—Registered 5th February. Capital £2,000. Electrical equipment specialists, radar, radio, X-ray and gamma ray equipment specialists, etc. Directors: S. G. Lyle and A. E. Smith. Regd. office: 17a, Iliffe Yard, Amelia Street, S.E.17.

Bankruptcies

S. Maggs, lately carrying on business under the style of G.M.C. Electrical Co., at 3, Regent Street, Clifton, Bristol.—Receiving order made 28th January on a creditor's petition.

G. A. Adams, 51, Hollyfaste Road, Sheldon, Birmingham, motor body builder inspector, previously carrying on business at first in partnership with another, at 90, Jamaica Row, Birmingham, and latterly from 1, Ings Road, Wombwell, East Riding, Yorks, under the style of Electro-Neon Lighting Co., electrical contractor.—Last day for receiving proofs for dividend 17th February. Trustee, Mr. W. H. Haigh, Official Receiver, Somerset House, 37, Temple Street, Birmingham, 2.

E. H. Tansey, residing and lately carrying on business at 53, Hollydale Road, Erdington, Birmingham, 24, electrical contractor.—Supplemental dividend of 3¾d in the £, payable on and after 21st February at the Official Receiver's Office, Somerset House, 37, Temple Street, Birmingham, 2.

N. W. Ives, North Street, Burnham Market, Norfolk, radio, cycle and electrical engineer.—Public examination 25th March at the Shirehall, Norwich.

J. E. Rippin, Egglestone's Yard, Sherwood Avenue, Newark-on-Trent, Notts, electrical engineer.—Trustee, Mr. E. C. Stimpson, 27, Regent Street, Park Row, Nottingham, Official Receiver, released 28th January.

Liquidations

Electric Utilities, Ltd. (in voluntary liquidation).—Particulars of claims by 15th March to the liquidator, Mr. A. S. Holmes, Barclays Bank Chambers, 44, High Street, Southall, Middx.

Woking Electrical Installations, Ltd., "Hascombe," Brooklyn Road, Woking, Surrey.—Liquidator, Mr. H. C. Treby, 29-30, High Holborn, London, W.C.1, appointed 21st January (with committee of inspection).

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 22nd February:—

ROCKWELD. No. B763,242. Class 7. Electrical welding machines and electric generators.—Rockweld, Ltd., Commerce Way, Croydon, Surrey.

DISHMAID. No. 770,127. Class 7. Dish washing machines; and dish drying machines.—Electrolux, Ltd., Electrolux Works, Oakley Road, Luton, Beds.

SPRAGUE. No. B741,171. Class 9. Electrical capacitors.—Sprague Electric Co., North Adams, Mass., U.S.A. Address for service, c/o Stevens, Langner, Parry & Rollinson, 5 to 9, Quality Court, Chancery Lane, W.C.2.

ROOMTROL. No. 760,627. Class 9. Thermostatic regulators.—Robertshaw-Fulton Controls Co., Greensburg, Penn., U.S.A. Address for service, c/o Frank B. Dehn & Co., Kingsway House, 103, Kingsway, London, W.C.2.

HORTIWARM. No. 771,281. Class 9. Covered electric wire and electric cables.—Wandleside Cable Works, Ltd., 106, Garratt Lane, Wandsworth, London, S.W.18.

CANNON. No. 769,403. CANNON (design). No. 769,705. Class 11. Electric heating and cooking apparatus and appliances.—Cannon (Holdings), Ltd., Deepfields, near Bilston, Staffs.

KAYDELITE. No. 769,796. Class 11. Electric lighting fittings.—Spencer Metalcraft (London), Ltd., Gilbert Works, Easthampstead Road, Bracknell, Berks.

Catalogues and Lists

ELECTRIC FENCES.—Illustrated booklet dealing with electric fencing for wild animals.—**Wolseley Engineering, Ltd.**, Electric Avenue, Witton, Birmingham, 6.

FURNACES.—Descriptive leaflet on resistance heated bogie hearth furnaces.—**G.W.B. Furnaces, Ltd.**, P.O. Box No. 4, Dibdale Works, Dudley, Worcs.

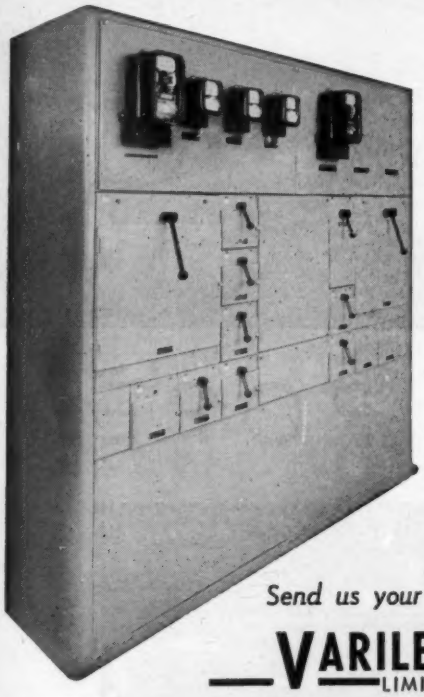
INSPECTION LAMP.—Leaflet describing the "Limpet" positive grip inspection lamp.—**Harold Jackson (Electrical Engineer)**, 129, St. Mary's Road, Sheffield, 2.

MERCURY SWITCHES.—23-page catalogue (1158) illustrating and describing a selection of the types of mercury switches and relays produced by the company.—**I.A.C., Ltd.**, Chase Road, London, N.W.10.

NUCLEONIC GAUGES.—24-page catalogue illustrating and describing the range of "Ekco" nucleonic gauges.—**Ekco Electronics, Ltd.**, Ekco Works, Southend-on-Sea, Essex.

PACKAGING.—Booklet illustrating the use of the company's p.v.c. containers and covers for the protection of electrical measuring instruments, portable record players and similar products.—**Denbar, Ltd.** (Instrument Protection Division), Farringdon House, 134-146, Curtain Road, London, E.C.2.

Cubicle Switchboards



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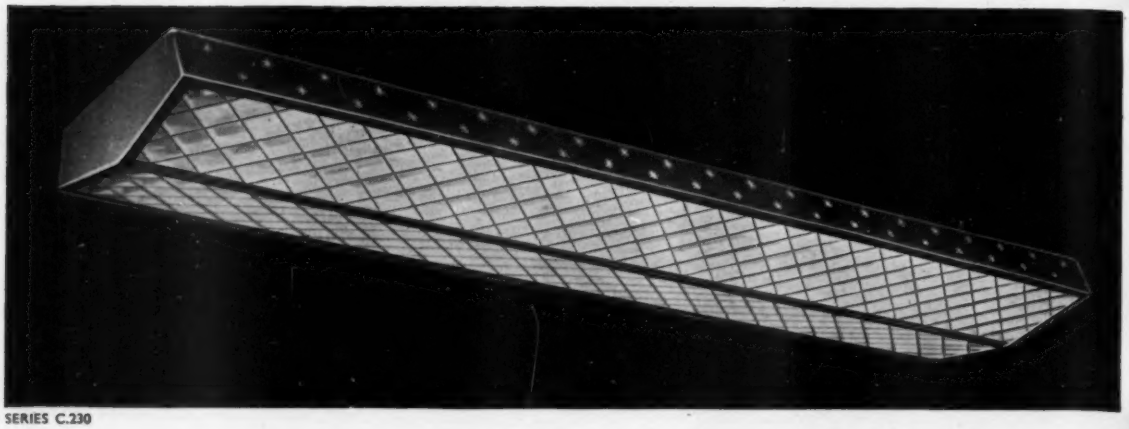

SERIES C.230

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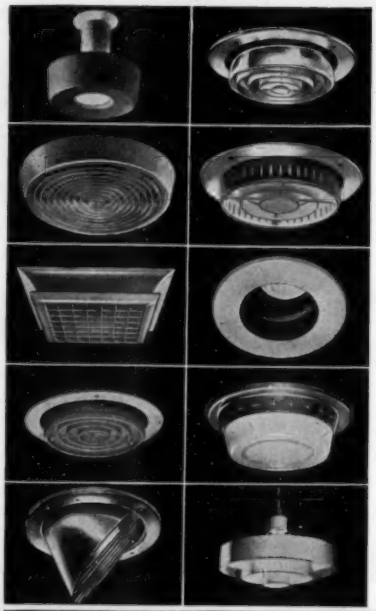
C.264

D.19

C.74

D.4/R

D.153



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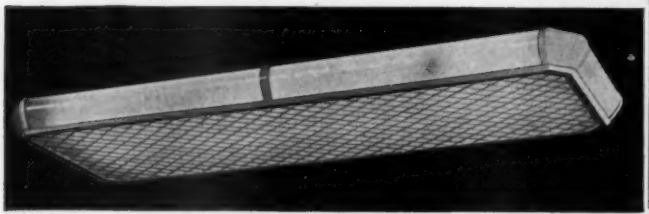

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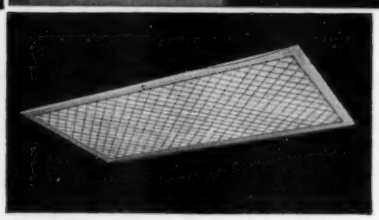

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STAMFORD HILL 1270 (Fifteen Lines)

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CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Argentina.—Water and Electric Power Board, Buenos Aires. 26th June. Electro-mechanical plant for El Nihuil No. 3 hydro-electric station. (E.S.B. 3105/58. Ten/30804.)*

Australia.—Overseas Telecommunications Commission, Sydney. 7th March. Five-unit start/stop telegraph machines. (E.S.B. 2508/58. Ten/30656.)*

Western Australian Government Tender Board. 27th March. Sealed unit capacitors. (E.S.B. 2784/58. Ten/30763.)*

Bilston.—Borough Council. 26th February. Supply and erection on various estates of 46 60 W sodium group "B" lamps. Borough engineer, 20, Wellington Road.

Birkenhead.—Corporation. 28th February. Electric lamps for year ending 31st March, 1959. (See this issue.)

Bristol.—Hortham-Brentry Hospital Management Committee. Supply of engineering and electrical material for the 12 months ending 31st March, 1959. Secretary, Brentry Hospital, Westbury-on-Trym, Bristol.

Southmead Hospital Group. Supply of electric lamps. C. C. Hancock, secretary, Southmead Hospital, Bristol.

Burma.—Burma Purchasing Board, Rangoon. Ceiling fans. (E.S.B. 3487/58. Ten/30821.)* Ironclad batteries. (E.S.B. 3485/58. Ten/30822.)* House service meters. (E.S.B. 3488/58. Ten/30823.)* Carbon brushes. (E.S.B. 3486/58. Ten/30832.)*

Herefordshire. — Herefordshire Hospital Management Committee. Electrical rewiring of 13 estate houses. (See this issue.)

India.—Damodar Valley Corporation, Calcutta. 25th March. Control panels and d.c. auxiliary switchboards for Durgapur power station. (E.S.B. 3113/58. Ten/30748.)*

Iraq.—Directorate General of Municipalities, Baghdad. 22nd February. L.v. feeder panels for substations for the Basrah Water and Electricity Board. (E.S.B. 2365/58. Ten/30638.)* 1st March. 150 kW generating set and accessories. (E.S.B. 3106/58. Ten/30767.)* Electric meter testing equipment. (E.S.B. 3108/58. Ten/30779.)*

Central Foreign Purchasing Committee, Ministry of Finance, Baghdad. 28th February. Insulated wire and cable. (E.S.B. 2368/58. Ten/30629.)* Electricity meters. (E.S.B. 2369/58. Ten/30650.)*

Baghdad Sewerage Board. 1st June. 53 electrically driven centrifugal sewage pumping units. (E.S.B. 2275/58. Ten/30634.)*

Kuwait.—Department of Electricity. 3rd March. Substation medium voltage distribution boards. (E.S.B. 2709/58. Ten/30708.)*

Leicester.—Welfare Committee. 25th February. Electrical installation at the old people's homes, Nether Hall estate. J. H. Lloyd Owen, city architect, 10, Loseby Lane.

New Zealand.—Dunedin Electricity Department. 21st February. Electric insulators and pins and tension sets. (E.S.B. 3164/58. Ten/30768.)*

Christchurch Electricity Department. 25th February. Insulated cable. (E.S.B. 2953/58. Ten/30774.)* 18th March. Varnished cambric insulated cable. (E.S.B. 2954/58. Ten/30775.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

Newry (Co. Down).—7th March. Electrical installation work in the proposed new extension to St. Colman's College, and in the renovation of the science block. S. G. Timoney, consulting engineer, 144, Lower Baggot Street, Dublin.

Pakistan.—Posts and Telegraphs Department, Karachi. 25th February. Condensers. (E.S.B. 2737/58. Ten/30684.)* Caps for telephone switchboard lamps. (E.S.B. 2738/58. Ten/30691.)* Loading pots. (E.S.B. 3051/58. Ten/30747.)*

Rhodesia and Nyasaland.—Salisbury City Council. 11th March. Pumps, electric motors and starters. (E.S.B. 2495/58. Ten/30646.)*

Bulawayo Electricity Department. 5th March. Two 10,000 kVA and two 40,000 kVA transformers. (E.S.B. 2991/58. Ten/30716.)*

South Africa.—Union Tender & Supplies Board, Pretoria. 10th April. V.h.f. omni-range equipment at various airports. (E.S.B. 2063/58. Ten/30665.)*

Stores Department, South African Railways, Johannesburg. 26th February. 3-unit switchboard. (E.S.B. 2988/58. Ten/30713.)* Telegraph line material. (E.S.B. 3048/58. Ten/30742.)* 7th March. Signalling cable. (E.S.B. 3047/58. Ten/30745.)* 25th April. Lighthouse equipment. (E.S.B. 3049/58. Ten/30764.)*

Transvaal Provincial Tender Board, Pretoria. 21st February. Electric ovens. (E.S.B. 3622/58. Ten/30838.)*

Spenborough.—Corporation. 24th February. Street lighting equipment. (See this issue.)

Sudan.—Posts and Telegraphs Department, Khartoum South. 1st March. Telephone wires. (E.S.B. 3013/58. Ten/30703.)*

Thailand.—Thai Technical and Economic Committee, Bangkok. 1st April. Two 6,250 kW generating units, lignite fired boilers and auxiliaries. (E.S.B. 2354/58. Ten/30615.)*

United States.—Bureau of Reclamation, Denver. 25th February. One indoor 750 kVA unit substation. (E.S.B. 3768/58. Ten/30874.)*

Walsall.—Borough Council. 24th February. Electrical repairs to Council houses for two years commencing 1st April next. A. E. Bywater, housing manager, Housing Repairs Department, 7, Hatherton Road.

Wandsworth.—Borough Council. Applications are invited for inclusion in the Council's list of electrical contractors. (See this issue.)

Wigan.—Corporation. 7th March. Street lighting equipment. (See this issue.)

ORDERS PLACED

Brentford and Chiswick.—Corporation. Recommended. Street lighting installation, Cromwell Road extension (£4,561).—Concrete Utilities.

Dagenham.—Public Cleansing and Sewerage Committee. Pumping and electrical equipment for new pumping station, Chequers Lane (£2,175).—Wallwin (Pumps).

Glasgow.—Health and Welfare Committee. Electrical installation work at clinic, Drumchapel (£2,561).—Mobile Electrical Services.

Education Committee. Installation work at primary school, Easterhouse (£3,284).—J. B. Meiklejohn.

Housing Committee. Installations in 24 houses, Kilmarnock Road, Auldhouse (£1,822).—James Kilpatrick & Son.

Cleansing Committee. Installation work at amenities block, etc., Refuse Disposal Works, Polmadie (£6,854).—B. French.

Leyland (Lancs).—U.D.C. Mercury vapour street lighting installation (£6,493).—Revo Electric Co.

London.—London Transport. Electrical installation work at Upminster railway depot. —Troughton & Young.

Reading.—Corporation. Accepted. Electric wiring work, Whitley estate: 89 houses (£1,463).—Hammants (Henley); 207 houses (£3,780).—Southern Electricity Board. Recommended. Wiring of 308 houses, Whitley estate (£5,373).—S.E.B.

South Shields.—Corporation. Electrical equipment for underfloor heating in blocks of flats to be built on St. Mark's housing site (£6,610).—Pyrotenax.

Wolverhampton. — Corporation. Recommended. Electrical installation work at new retail market (£30,859).—J. A. Brown & Partners (Contracts).

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Aylesbury.—Houses (40), Northumberland Avenue; Barnard Investment Co., Ltd., 73, Acre Lane, London, S.W.2.

Barnsley.—Fire Service headquarters, Broadway (£95,000); borough engineer.

Bletchley.—Two factories, industrial area; U.D.C. surveyor.

Boston.—Proposed new general hospital; J. Martin & Co., surveyors to the Hospital Board, 8, Bank Street, Lincoln.

Bristol.—Modern laboratories and classrooms at Cathedral School (£30,000); Henry Willcock & Co., Ltd., contractors, Bristol.

Carlisle.—Factory additions, Rome Street, for J. T. Scott & Co.; W. R. Jeffrey, architect, 24, Bank Street.

Additions to Barn Close Home (£30,000); H. Cartner & Son, builders, Knowe Terrace.

Chester.—Extensions, City High School; Saxon Smith & Partners, architects, 2, Stanley Street.

Corby.—Second instalment of technical college; county architect, Northampton.

Dorchester.—Houses (200) for employees of Winfrith Heath Research Establishment; borough engineer, Guildhall Chambers.

Dundee.—Houses (334), City Road area; R. Dron, city architect, 17, City Square.

East Suffolk.—Extensions to Roman Hill School, Lowestoft (£50,000) and Claydon Modern School (£55,000); county architect, County Hall, Ipswich.

Exeter.—Extensions to Digby Hospital (£272,650); C. P. Unwin & Sons, Ltd., builders, 33, St. Peter Street, Tiverton.

Gateshead.—New Hill Head Secondary Modern School; Tate & Holmes, Ltd., builders, Benwell, Newcastle-on-Tyne.

Haddington.—Houses (250), in connection with Glasgow overspill; burgh surveyor, Haddington, East Lothian.

Harrow.—Four 4-storey blocks of flats, Northolt Road, with further blocks at a later date; borough engineer.

Hartley Wintney.—Houses (69), Manor Park estate; P. J. Mitchell, R.D.C. surveyor, Council Offices, Hartley Wintney, Hants.

Hebburn (Co. Durham).—Houses (131), Elmfield Road; U.D.C. surveyor.

Houghton-le-Spring.—Shops at Shiney Row for J. G. Usher & Son, auctioneers, Middle Chare, Chester-le-Street.

Ilford.—Maisonnettes (56), off Walden Way; W. J. Beckett, surveyor, 101, Wanstead Lane.

Jarrow.—Houses (280); borough engineer.

Leicester.—First part of Department of Chemistry at Leicester University (£400,000); Wilson, Lovatt & Sons, Wolverhampton.

London.—Multi-storey garage, Houndsditch; Mitchell Engineering, Ltd., 1, Bedford Square, W.C.1.

Showrooms and offices, Lower Marsh, Lambeth; Yeomans & Partners, Ltd., builders, 41, Upper Berkeley Street, W.1.

First stage of new buildings for Middlesex Hospital Medical School; J. Jarvis & Sons, Ltd., builders, 239, Vauxhall Bridge Road, S.W.1.

Factory, Mund Street, West Kensington; Hammond J. Harvey, architect, 8/10, King Street, W.6.

Loughborough.—Extensions to residential and teaching buildings, Ashby Road, for the College of Technology (£1,620,000); Oscar Faber & Partners, consulting engineers, 29, Queen Anne Street, London, W.1.

Luton.—Houses (550), Sundon area; H. C. Janes, Ltd., builders, 183, Hightown Road.

Middlesbrough.—Swimming baths, public library, community hall, health centre, etc. (£200,000); Jackson & Edmond, architects, Colmore Row, Birmingham.

Flats, Longlands Road; J. G. L. Poulson, architect, 171, Albert Road, Middlesbrough.

Northfleet.—Extensions to offices (£20,000), for U.D.C.; G. A. Rattray, builder, Saddington Street, Gravesend.

Plymouth.—Factory extensions; Fisons, Ltd., Harvest House, Cattedown.

Ruthin.—Extensions and adaptations at Ruthin Castle, to form county offices (£65,000); R. McFarlane, Denbighs. county architect, Grove Park, Wrexham.

Solihull.—New out-patients' department, extra staff accommodation and preliminary training school at Solihull Hospital; Birmingham Regional Hospital Board, 10, Augustus Road, Birmingham, 12.

Southampton.—Secondary school for girls, Millbrook; Howard V. Lobb & Partners, architects, 20, Gower Street, London, W.C.1.

Stoke-on-Trent.—Medical group practice centre, Blurton; W. Ball & Sons, Ltd., builders, Sutherland Buildings, Trent Vale.

Sunderland.—R.C. infants' school at Southwick; R. Burke, architect, 10, Lambton Road, Newcastle-on-Tyne.

Wakefield.—Houses and flats (91), as development of the Primrose Hill area; city engineer, Town Hall.

Whitley Bay.—Further houses, Fold housing site (£17,000); E. Roberts, borough engineer.

Wortley.—Houses (68), Lump Lane, Grenoside; Arthur Wikeley, surveyor to R.D.C., Council Offices, Grenoside, Sheffield.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) will be obtainable after 19th February from the Patent Office, 25, Southampton Buildings, London, W.C.2

1952

32634. Superheater Co., Ltd., and Peregrine, E. P.—Heat exchangers. 22nd March, 1954. (791035.)

1953

15939. Standard Telephones & Cables, Ltd.—Electric telegraph exchange systems. 4th June, 1954. (790914.)

19832. Electric & Musical Industries, Ltd.—Apparatus for generating randomly timed electrical pulses. 19th July, 1954. (790761.)

35333. British Thomson-Houston Co., Ltd.—Application of powdered luminescent materials to the envelopes of electric discharge lamps. 14th December, 1954. (791036.)

1954

1885. British Thomson-Houston Co., Ltd.—Contour machining apparatus. 20th January, 1955. (791031.)

6374. Egyesült Izzolampa es Villa-Mossagi Rt.—Supply cathodes. 4th March, 1954. (790899.)

10268. Jacobsens Elektriske Verksted Aktieselskap, N.—Electromagnetic relays. 10th April, 1956. (790915.)

12324. Weisheit, G., and Weisheit, H. and Research Interests, Ltd.—Semi-conductors with temperature variable resistivity. 28th April, 1954. (790764.)

16145. Dorman & Smith, Ltd.—Electric switch boxes and switches and their operating mechanism carried therein. 19th August, 1955. (790766.)

17292. Standard Telephones & Cables, Ltd.—Control circuit for pulse generator. 11th June, 1954. (790768.)

18980. Simplex Electric Co., Ltd.—Thermostats or other temperature responsive control devices. 28th July, 1955. (790901.)

20109. Eldi-Feinmechanik Ges.—Electric totalisers. 9th July, 1954. (790847.)

21142. British Thomson-Houston Co., Ltd.—Electronic circuits. 19th July, 1955. (791032.)

22618. Igranic Electric Co., Ltd.—Snap-action electric switches. 4th August, 1954. (790848.)

31699. Siemens-Schuckertwerke Akt.-Ges.—Processes for the production of selenium rectifiers. 2nd November, 1954. (791053.)

34814. General Electric Co., Ltd.—Liquid resistance controllers. 1st December, 1955. (790774.)

36196. General Electric Co.—Electric control systems. 14th December, 1954. (791054.)

36728. International Business Machines Corporation.—Current multiplication transistor. 20th December, 1954. (790855.)

37679. British Thomson-Houston Co., Ltd.—Electric circuit arrangements. 1st December, 1955. (791033.)

1955

358. British Messier, Ltd.—Remote control servo systems. 4th January, 1956. (791055.)

492. Vauxhall Motors, Ltd.—Control system for a double-acting fluid-pressure operated servomotor. 5th January, 1956. (790776.)

727. British Thomson-Houston Co., Ltd.—Lighting fittings. 10th January, 1956. (791056.)

4800. Sperry Corporation.—Automatic frequency control systems. 17th February, 1955. (790778.)

8000. British Dielectric Research, Ltd.—Electric capacitors. 19th March, 1956. (790860.)

9583. Carter, A. C., and Plowman, J. M.—Electromagnetic vibratory apparatus for vibrating moulds for concrete and the like. 9th March, 1956. (790861.)

10582. Automatic Telephone & Electric Co., Ltd.—Contact banks for automatic switches. 12th April, 1956. (791060.)

12661. Philips Electrical Industries, Ltd.—Deflecting coil systems for cathode-ray tubes. 2nd May, 1955. (791039.)

15223. General Electric Co.—Method of treating luminescent materials. 26th May, 1955. (790925.)

18647. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Electrical methods and apparatus for engraving plates. 28th June, 1955. (791009.)

18736. Electric & Musical Industries, Ltd.—Magnetic transducing heads. 4th June, 1956. (790909.)

21724. General Electric Co.—Transistor oscillator circuits. 27th July, 1955. (790932.)

21751. General Electric Co., Ltd.—Nuclear reactors. 26th July, 1956. (791011.)

21759. Thompson Products Inc.—Apparatus for controlling the operation of turbine-driven alternators. 27th July, 1955. (790867.)

21768. Dorman & Smith, Ltd.—Portable hand electric lamps. 4th July, 1956. (791012.)

27787. Ferguson Radio Corporation, Ltd.—Multi-vibrator circuits using transistors. 14th September, 1956. (790941.)

30470. Philips Electrical Industries, Ltd.—Microtomes. 25th October, 1955. (791042.)

32304. Philips Electrical Industries, Ltd.—Glow discharge tubes. 11th November, 1955. (790946.)

33281. British Thomson-Houston Co., Ltd.—Computing arrangements. 20th January, 1955. (Divided out of 791031.) (791034.)

35596. Philips Electrical Industries, Ltd.—Stabilised high frequency multi-channel generators. 12th December, 1955. (790807.)

36650. Egyesült Izzolampa es Villa-Mossagi R. T.—Cathode assemblies and a method of making them. 21st December, 1955. (790900.)

37144. Collins Radio Co.—Remote control system. 28th December, 1955. (791045.)

37275. General Electric Co.—Electroluminescent phosphor. 29th December, 1955. (790951.)

1956

1229. Standard Telephones & Cables, Ltd.—Method of cleaning semi-conductor material. 13th January, 1956. (790954.)

1995. Philips Electrical Industries, Ltd.—Sodium-vapour discharge lamps. 20th January, 1956. (790955.)

3628. Mullard Radio Valve Co., Ltd.—Methods for the manufacture of very high frequency electronic tubes. 6th February, 1956. (791019.)

5012. Western Electric Co., Inc.—Electric switches of the mercury type. 17th February, 1956. (790958.)

5645. Philips Electrical Industries, Ltd.—Low pressure arc discharge tubes. 23rd February, 1956. (790959.)

6631. Collier, R.—Electric thermal switches. 2nd March, 1956. (790961.)

6662. Siemens-Schuckertwerke Akt.-Ges.—Contact convertors. 2nd March, 1956. (791021.)

7615. Philco Corporation Soc. Anon.—Clothes washing machine and controls therefor. 12th March, 1956. (791047.)

15979. Français, Etat.—Self-filling electric batteries. 23rd May, 1956. (790971.)

20464. Landis & Gyr Akt.-Ges.—Bottom bearing for electricity meters. 2nd July, 1956. (790821.)

20544. National Cash Register Co.—Circuit for operating a magnetic-recording-writing head. 3rd July, 1956. (790974.)

22088. Philips Electrical Industries, Ltd.—Aperiodically back coupled transistor circuits. 17th July, 1956. (790976.)

28020. General Electric Co.—Reversible heat-transfer systems. 13th September, 1956. (790828.)

1957

11189. Standard Telephones & Cables, Ltd.—Induction coil incorporating the ringer. 5th April, 1957. (Addition to 790453.) (791070.)

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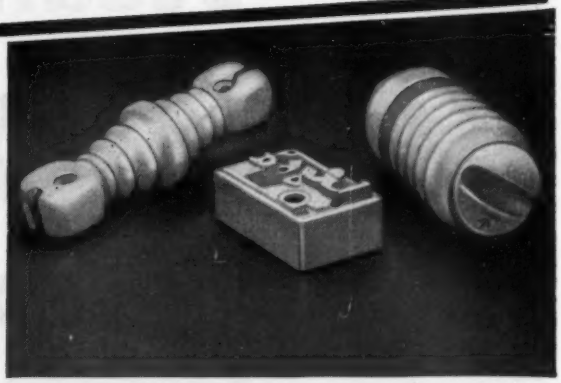

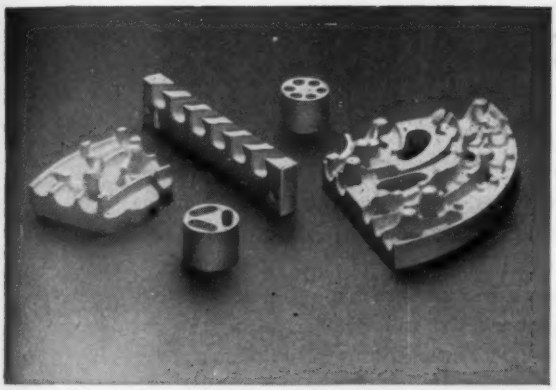

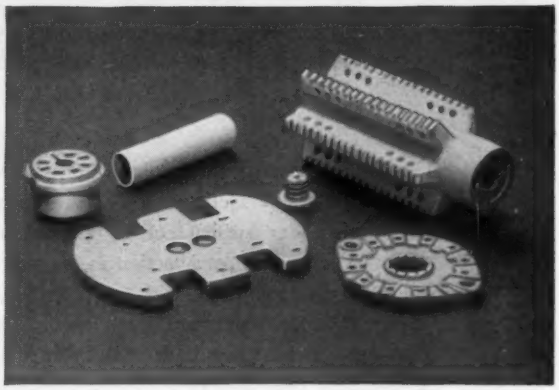

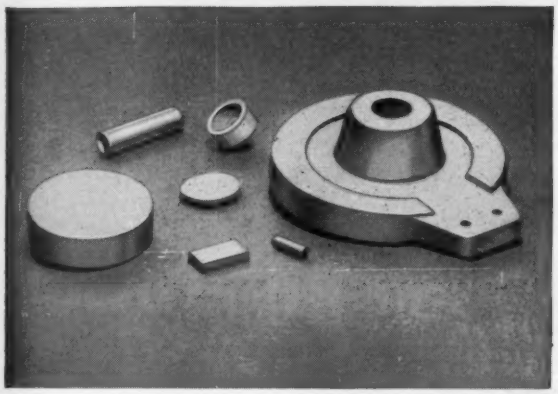

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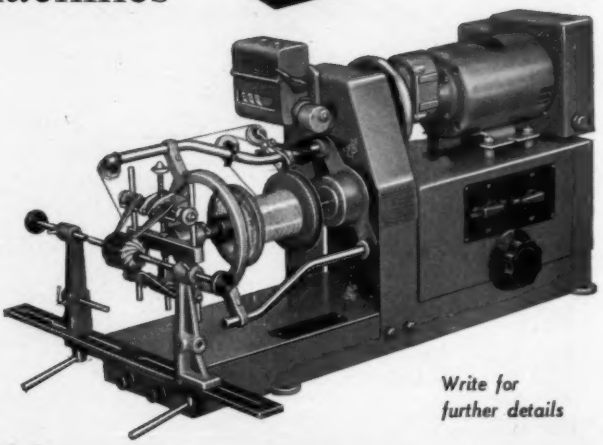

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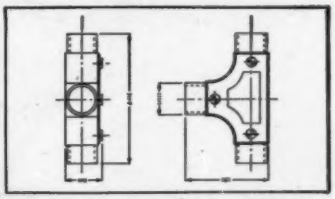

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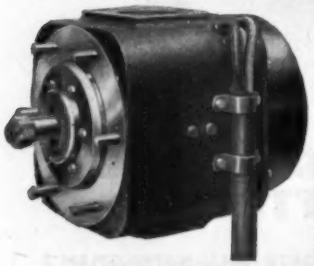

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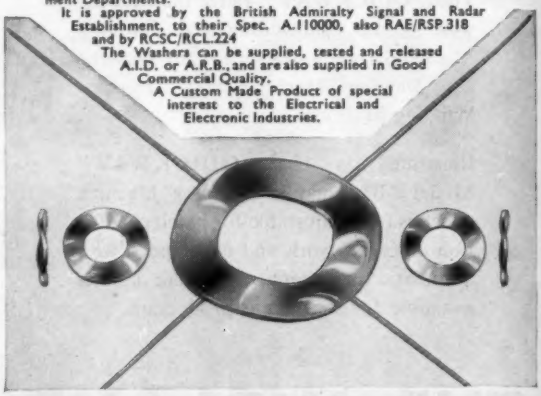

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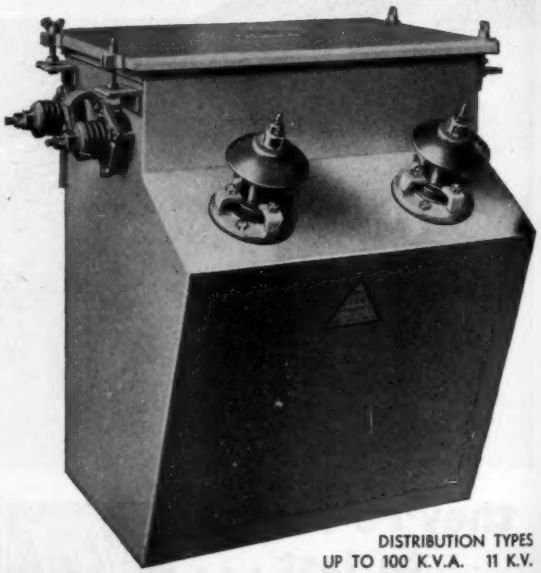

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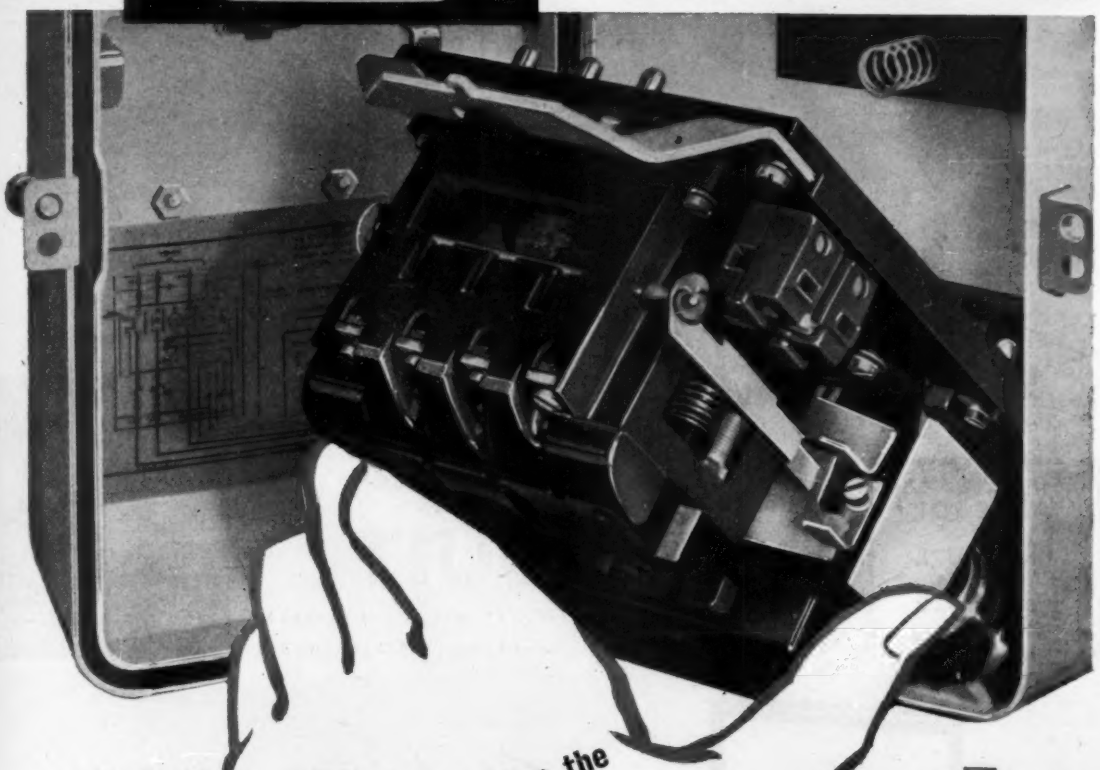

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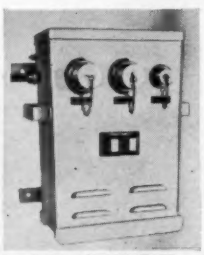

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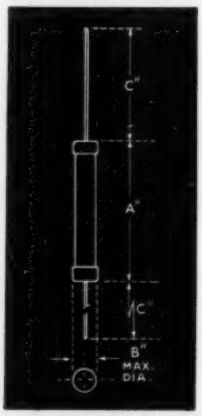


ELECTRICAL CHARACTERISTICS

The electrical characteristic of a High Stability Carbon Resistor depends upon the physical size of the units and upon the ohmic value. All the data given below relates to the Type 73 Resistor. To obtain the equivalent ohmic values to which the information is applicable in the other four sizes of Resistor the following factors should be applied :

Type 72 x ½ Type 74 x 2 Type 75 x 4 Type 76 x 8

FULL LOAD STABILITY

Up to 100 K.ohms the resistance change at full load with an ambient temperature of 70°C. is less than 0·75% (average 0·25%) after 1,000 hours operation. At 1 Megohm the change is less than 1% (average 0·75%).

N.B. On D.C. loading the maximum voltages stated in RCL 112 should be observed.

AGEING AND SHELF DRIFT.

Up to 100 K.ohms the average change is 0·25% in 12 months (never greater than 0·75%). For 1 Megohm resistors the average change is 0·6% in 12 months (never greater than 1·25%).

CLIMATIC

Exposure to the two cycles of H.I. humidity as laid down in RCS 112 shows a change of less than 0·7% (average 0·4%) up to 100 K.ohms. At 1 Megohm the change is less than 1% (average 0·7%).

TROPICAL EXPOSURE

Eighty-four days exposure to the standard 25°C./35°C. 100% humidity cycling shows a change of less than 1% (average 0·5%) up to 100 K.ohms. At 1 Megohm the change is less than 2% (average 1·6%).

TEMPERATURE COEFFICIENT

The temperature coefficient is less than 0·04%/°C. up to 100 K.ohms. At 1 Megohm the coefficient is approximately 0·055%/°C.

NOISE

Noise which is generated in a resistor, as the result of a direct voltage applied across it, varies according to the ohmic value of the resistor, the noise decreasing as the ohmic value increases. The noise is also influenced by factors such as the size of the resistor.

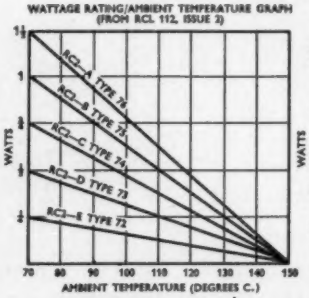
For noise which falls within frequency range of 0 to 10 Kc./sec., the Painton high stability resistors have noise levels which are between 0·05 and 0·4 microvolts of noise per applied direct volt, when the resistor is dissipating power at its maximum wattage rating.

VOLTAGE COEFFICIENT

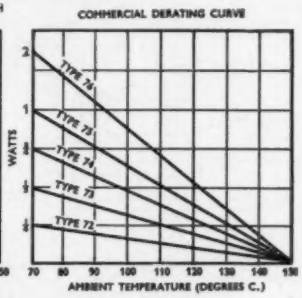
Not exceeding 0·002% per volt D.C.

DERATING FOR AMBIENT TEMPERATURES EXCEEDING 70° C.

WATTAGE RATING/AMBIENT TEMPERATURE GRAPH (FROM RCL 112, ISSUE 2)



COMMERCIAL DERATING CURVE



TYPE	RESISTANCE RANGE (ohms)	VALUES OUTSIDE THIS RANGE MAY BE QUOTED FOR SEPARATELY.	
72	±1% 4—700K	±2% 4—1·0M	±5% 4— 2·5M
73	±1% 4—1·0M	±2% 4—2·0M	±5% 4— 5·0M
74	±1% 20—2·0M	±2% 20—4·0M	±5% 20—10·0M
75	±1% 20—3·0M	±2% 20—5·0M	±5% 20—10·0M
76	±1% 20—5·5M	±2% 20—9·0M	±5% 20—50·0M

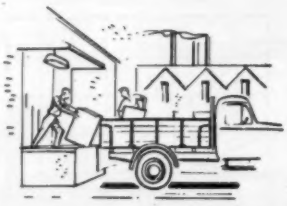
TYPE		72	73	74	75	76
Normal Commercial Rating 70°C—watts		¼	½	¾	1	2
R.C.S.C. style		RC2-E	RC2-D	RC2-C	RC2-B	RC2-A
R.C.S.C. Rating at 70°C—watts		¼	½	¾	1	1½
R.C.S.C. Rating at 100°C—watts		½	¼	½	¾	¾
DIMENSIONS IN INCHES	A	¼	⅜	1 1/16	1⅜	2 1/16
	B	1/16	1/16	1/16	1/16	1/16
	C	1⅛	1⅛	1⅛	1⅛	1⅛

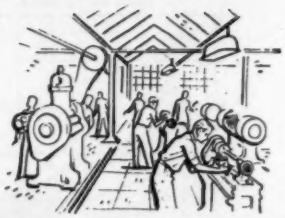
PAINTON

Northampton England

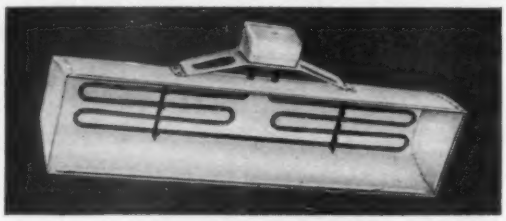
WARMTH projected where you need it!

METROVICK
Radiant Space Heater





Radiant space heating is the new idea for providing warmth for people at work, waiting in queues, watching games, shopping, etc. Thus in a large building it is possible to direct heat to just those areas where operatives are working.



Available from stock

The Metrovick radiant space heater consists of an anodised aluminium reflector with a tubular sheathed heating element rated at 3 kW at specified single phase voltages. It weighs under 5 lb. and is easily erected on a single 1 in. conduit from the die-cast aluminium alloy weather-proof terminal box.

Write to us to-day for full technical details.

METROPOLITAN-VICKERS
ELECTRICAL CO LTD · TRAFFORD PARK · MANCHESTER 17

LD 704

An A.E.I. Company

We'll be at KARIBA!

For the great Hydro-electric project at Kariba Gorge the METAFILTRATION CO. LTD., in association with The British Thomson-Houston Export Co Ltd., will be supplying Permanent *cold* purification, storage and pumping equipment for insulating oil used in the 330 kV. B.T.H oil circuit breakers, also the transformers, and reactors at each of the stations shown on the map.

METAFILTRATION will include in their supply:–
500 gallons/hour METAFILTERS
10,000 gallon oil storage tanks
13,000 gallons/hour transfer pumps
More than 3 *miles* of 2", 3" and 4" pipework!

The acceptance of the Metafilter *cold* filtration system for this great project is yet another fine tribute to the efficiency of our installations.

CHOOSE THE METAFILTER BACKED BY 29 YEARS EXPERIENCE.

Metafilters for transformers and switch oils are available as static, portable and fully mobile units with capacities from 50 g.p.h. to 1000 g.p.h.

Metafilter

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TRADE MARK

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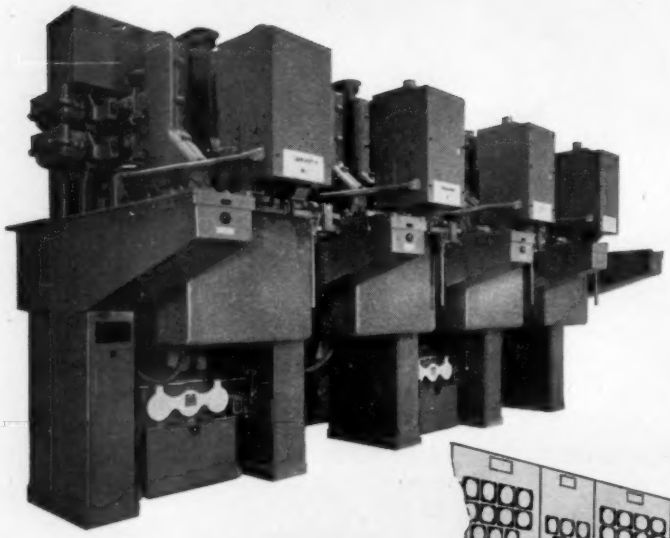
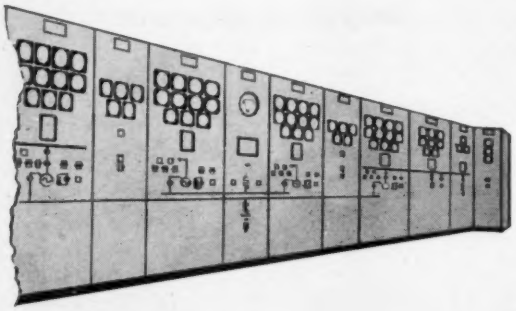
Telephone HOUnslow 1121-3



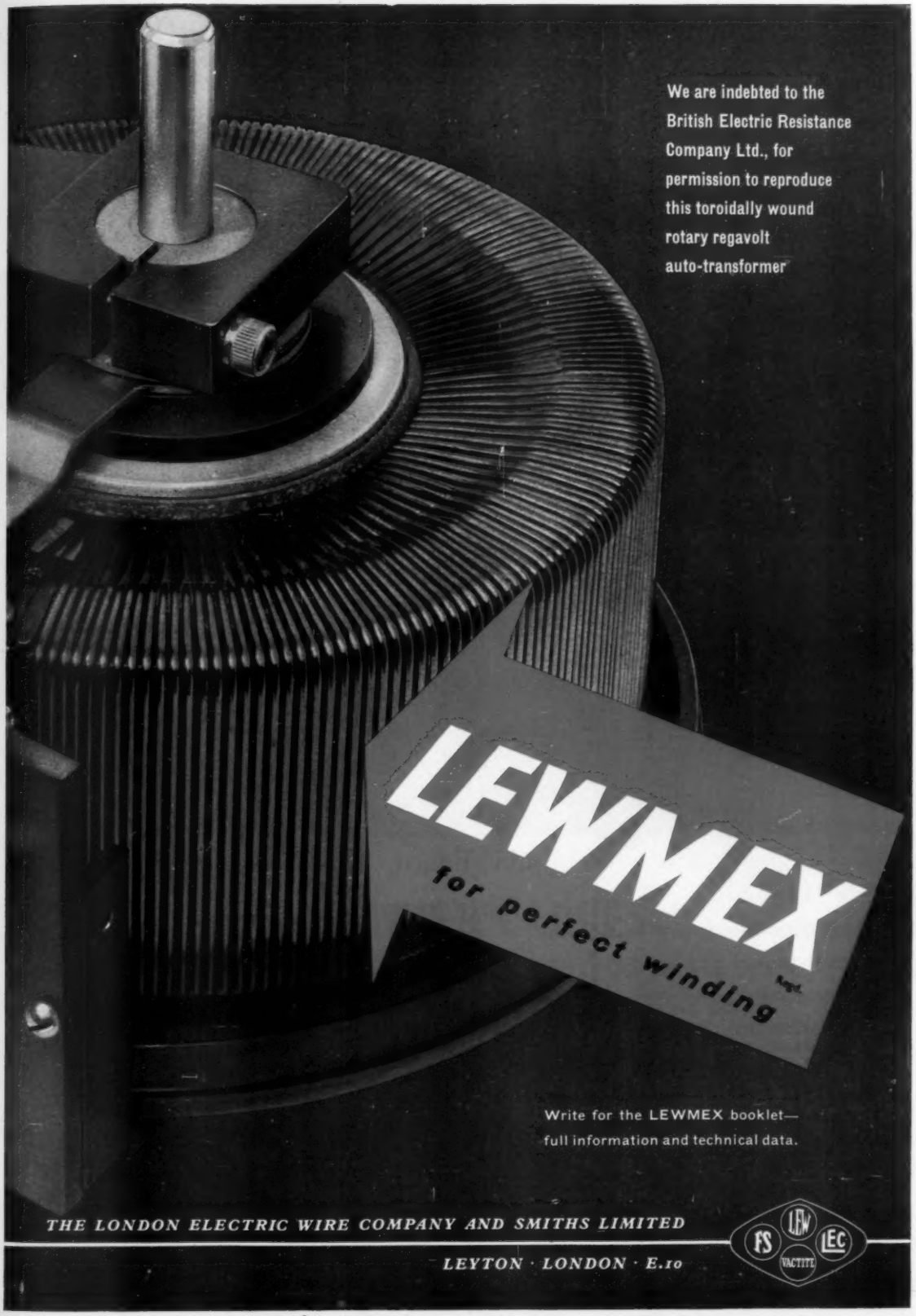
generator switchgear at Calder Hall



The generators at the
Calder Hall Power-station
of the Atomic Energy Authority
are controlled by Reyrolle
11-kV 500-MVA and
750-MVA switchboards
and their associated
control-boards

Reyrolle

A. REYROLLE & COMPANY LIMITED HEBBURN, COUNTY DURHAM, ENGLAND


We are indebted to the British Electric Resistance Company Ltd., for permission to reproduce this toroidally wound rotary regavolt auto-transformer
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for perfect winding
Write for the LEWMEX booklet— full information and technical data.
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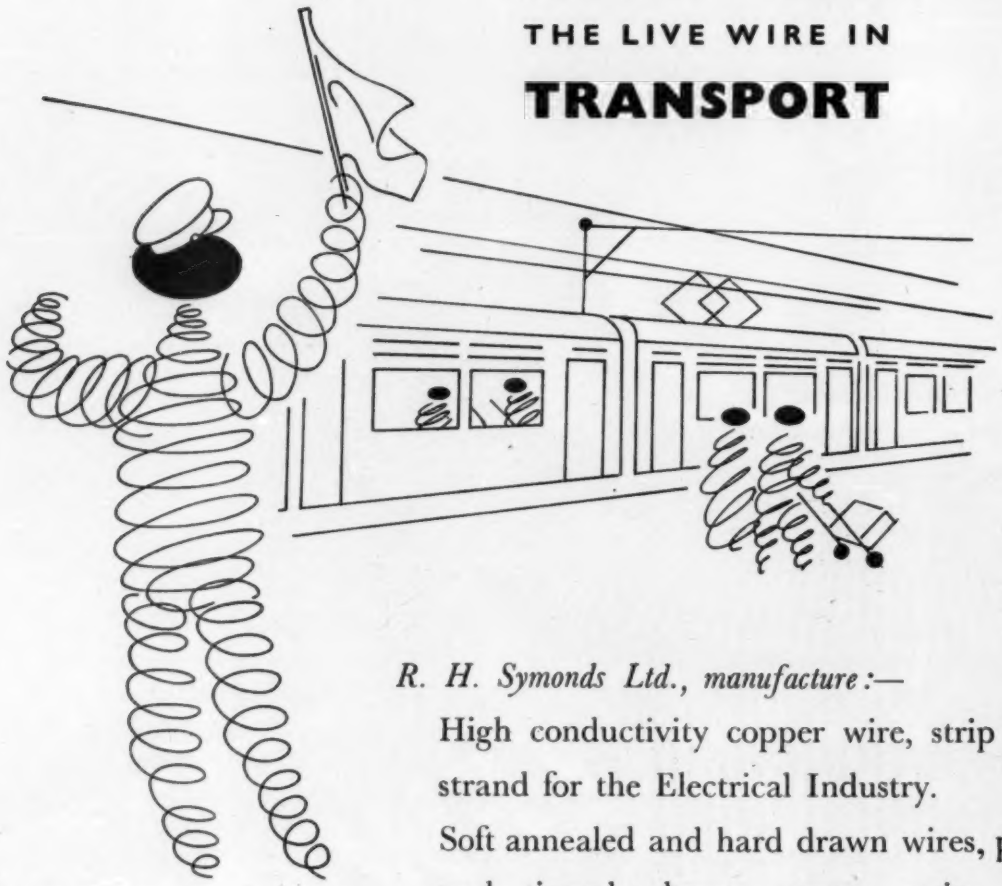

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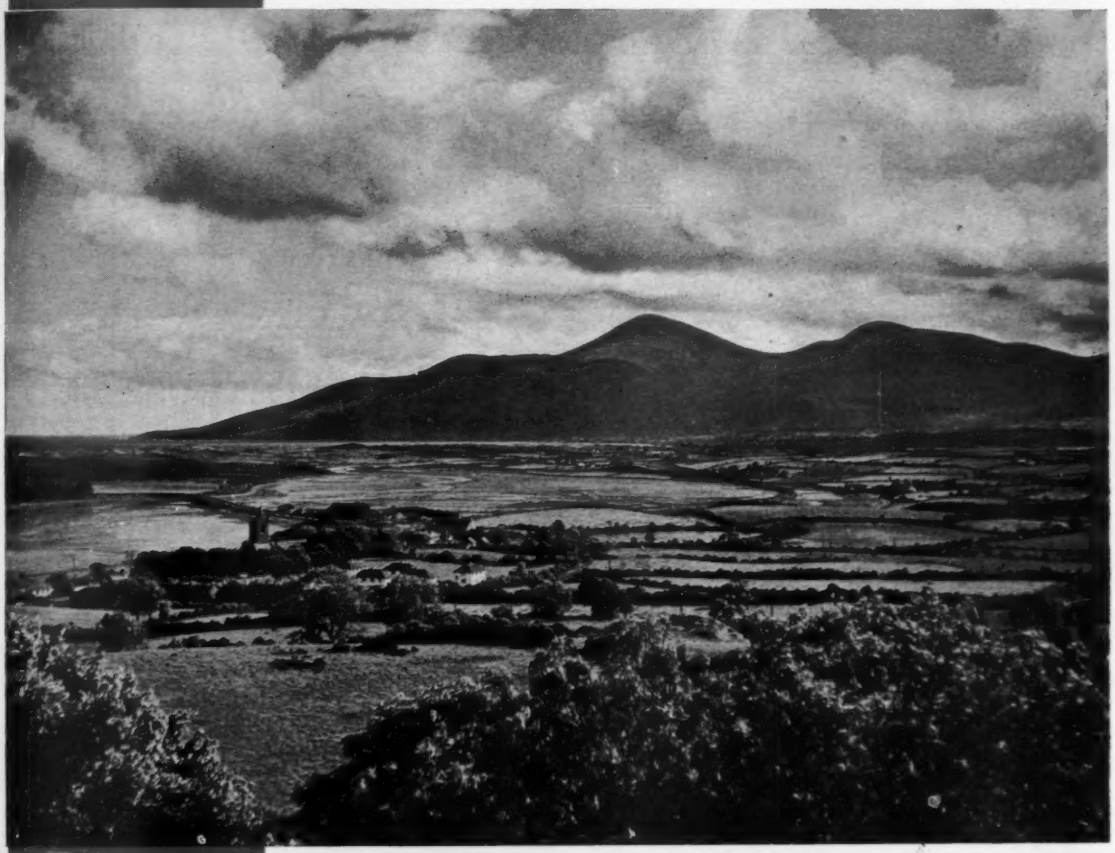
Works: Enfield, Middlesex.

'Tis distance lends enchantment to the view,
And robes the mountain in its azure hue.

(Pleasures of Hope by Thomas Campbell)



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Irish cables are manufactured amidst scenery depicted above, showing the famous and beautiful Mourne Mountains

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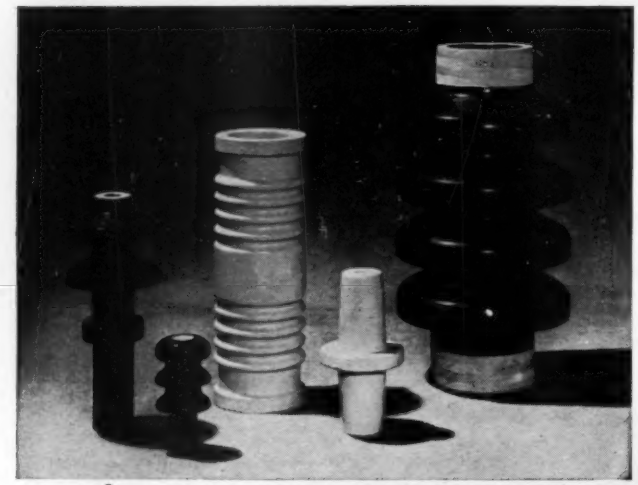

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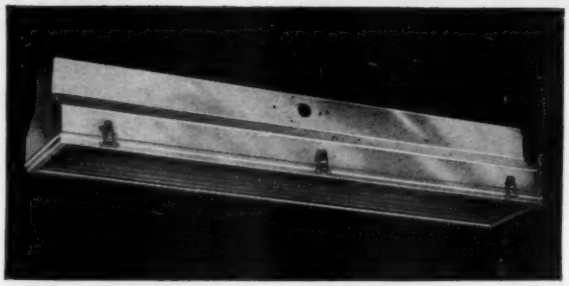

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COOKERS CAN NOW BE 100% SATCHWELL EQUIPPED...

. . . WITH THE INTRODUCTION OF THE Superswitch

Satchwell, always the first name in oven thermostats, now present the "Superswitch" infinite control for boiling plates.
Like all Satchwell products the "Superswitch" is another first-class instrument made by The Rheostatic Co. Ltd., and has, among many others, the following advantages :

INFINITE CONTROL
An unlimited number of settings—any heat from 8% to 100%.

CONSISTENT PERFORMANCE
Far higher consistency than that obtained from other forms of energy regulator.

FAST CYCLE TIME
Simmering at precisely the correct rate with any utensil is now practical.

EASY SETTING
Knob rotates 360° in either direction. Spring location at HIGH, LOW and OFF positions.

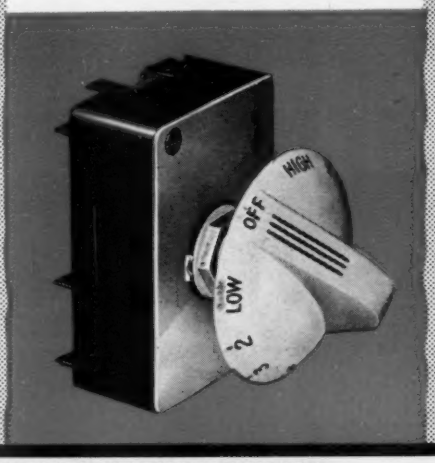
EASE OF INSTALLATION
Choice of solderless snap-on connectors or screw-clamping terminals. Proved reliability—no maintenance.

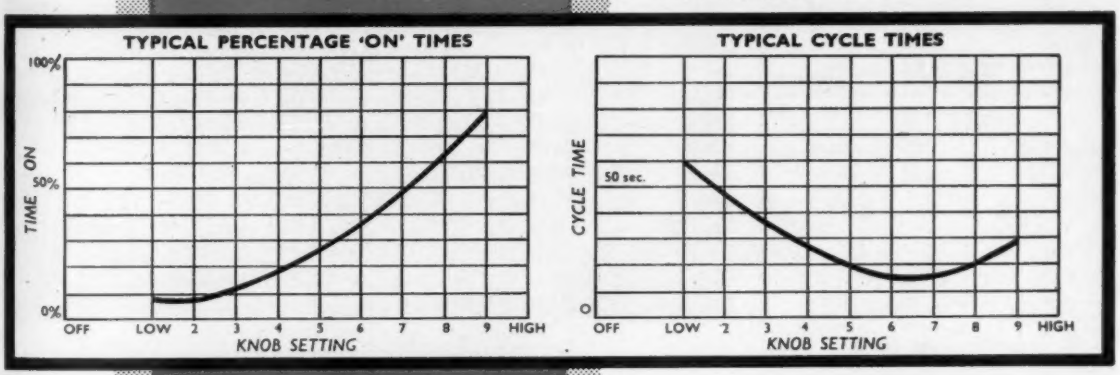
Please ask for your copy of List Number 106 which gives full details.

TWO TYPES AVAILABLE

BPC1—Gives complete control of standard boiling plate from very low to maximum heat—gentle simmering really is possible now.

BPC5—One knob gives infinite control of either inner ring or complete element of radiant plate; ideal for two-element boiling and boiler-griller plates.





SATCHWELL Superswitch

THE RHEOSTATIC CO. LTD. · SLOUGH · BUCKS
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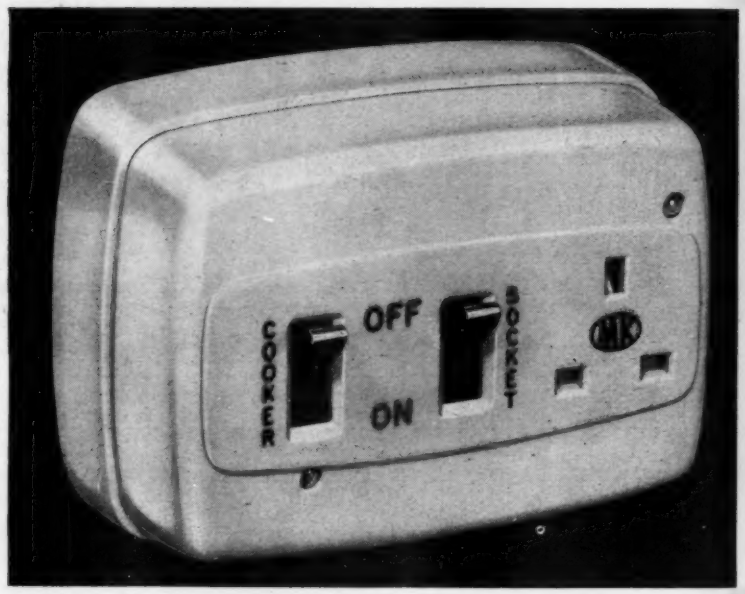
MK140DHB

A NEW all-insulated COOKER CONTROL UNIT

FOR SURFACE INSTALLATIONS this new all-insulated cooker control unit is extremely neat and compact. It has a tough, easy-to-clean case moulded in ivory of urea formaldehyde, and the switch handles are red in contrast. A self-contained mounting block is provided so that the unit can be fixed direct to the wall, and the cables are housed in an incombustible compartment with good entry facilities. The unit is designed for straight-through wiring and earthing. Maximum dimensions across the base are $5\frac{7}{8}$" x $4\frac{1}{4}$".



List No. 5040/646 *30 amp double pole AC surface cooker control unit with 13 amp double pole switchsocket-outlet, all-insulated pattern, ivory finish. Complete with ivory 13 amp fused plug,* **27/8** *each*

Also available with twin neon pilot-lights, **List No. 5041/646.** *Complete with two lamps and ivory 13 amp fused-plug.* **36/6** *each*

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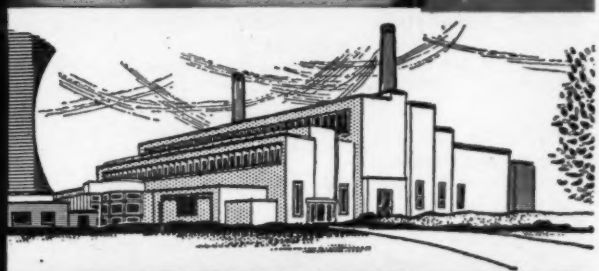
Pirelli-General 275 kV oil-filled cables have passed type approval tests on all conductor sizes up to 1·0 sq. in.

Consulting Engineers Mott & McLellan



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Oil-filled Cables

PIRELLI-GENERAL
CABLE WORKS LTD
SOUTHAMPTON

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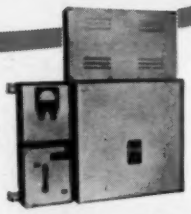
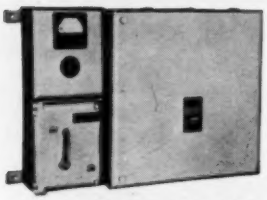
BKS RANGE OF AUTOMATIC MOTORSTARTERS

(Left)
Heavy Duty Direct On-Line Starters. Suitable for controlling motors up to 30 h.p.
List DO 60.



Automatic Stator Rotor Starters. Suitable for controlling slip ring motors up to 40 h.p.
List SR 60.



Heavy Duty Automatic Star Delta Starters. Suitable for controlling motors up to 55 h.p.
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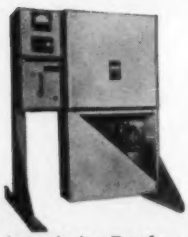

Automatic Auto Transformer Starters. Suitable for controlling motors up to 40 h.p.
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Searching out new knowledge, translating it into products people can use, and then making these products widely available, is the role of our technical engineers. The new range of automatic motor starters announced in this advertisement embody modern design and advanced construction features for economy in installation and service. Application for literature will be dealt with by return of post.

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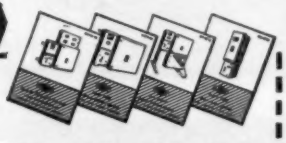

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Please send me copy of List **AT 60 SR 60 DO 60 SD 60**
INDICATE BY TICK WHICH LIST/S REQUIRED

NAME .....
POSITION .....
FIRM AND .....
ADDRESS .....
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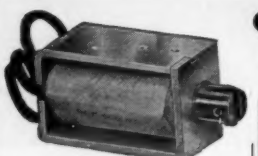

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Range covers types 41 and 42 (front 1" × 1¼") 38, 39 and 40 (front 1¼" × 1¾") and power A.C. and D.C. sizes up to 60 inch-lbs.

6 v-460 v A.C. and D.C. types

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Solenoids are normally despatched same day as receipt of order

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'I like to deal with suppliers who treat their customers as individuals rather than order numbers. You know — the personal touch. You get it with J. & P.'

'*Johnson & Phillips? They carry out some pretty big electrical projects, don't they?*'

'They do. But they still manage to make every customer feel they're pleased to handle his business.'

'*Shows the advantage of dealing with a medium-sized firm.*'

'Yes indeed. J. & P. are just the right size for me.'

THE RIGHT-SIZED FIRM FOR YOU

J. & P. manufacture cables, transformers, switchgear, capacitors, etc., and undertake electrification schemes for many of the largest industrial concerns in this country and overseas.

They have been in the business since 1875.

But they still retain that regard for the individual customer that only the smaller firms can have.

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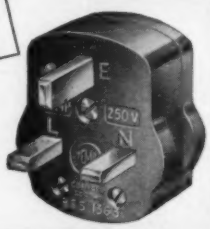

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These numbers

mean so much more

Ease in wiring, greater safety and higher electrical efficiency are not just glib phrases when applied to TEMCO WIRING ACCESSORIES. They definitely mean something, such as terminals conveniently positioned; more room for cables; a snap acting switch action that makes it impossible to draw a continuous arc by misuse; captive cover screws; neat, attractive, non-track mouldings. These are typical of the advantages that give TEMCO unquestioned superiority.

TEMCO

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T.M.C. – HARWELL (SALES) LTD

A subsidiary of Telephone Manufacturing Co. Ltd.

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These accessories are also available in cream. Please write for catalogue.

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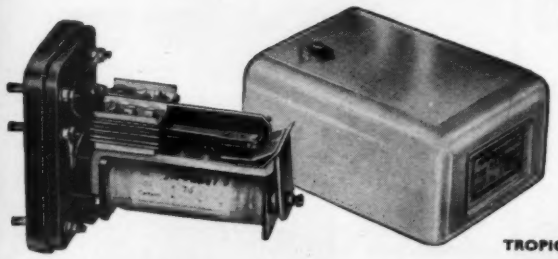
INSTANTA RELAYS

MODELS from our NEW RANGE

The others will interest you.
Why not get in touch?



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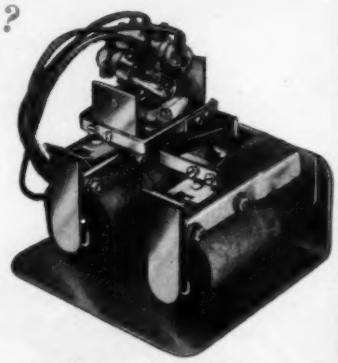

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Precision **TURNED FASTENERS**
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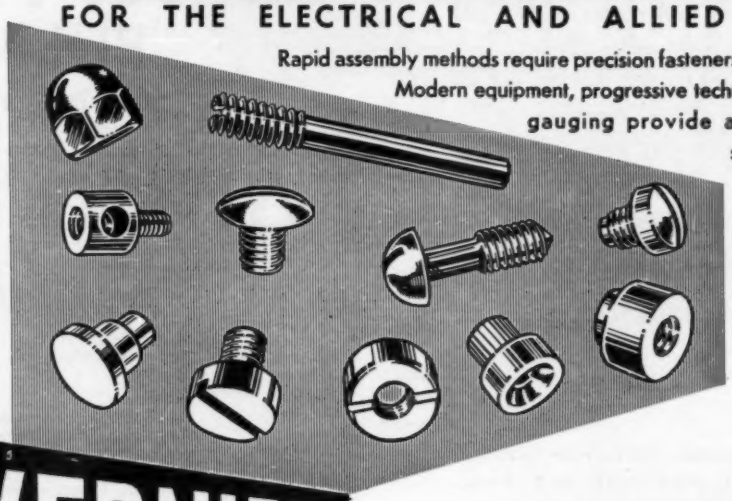
STOCKS of standard turned screws available for immediate use

Rapid assembly methods require precision fasteners and components. Modern equipment, progressive technique, and quality gauging provide an unsurpassed specialist service.



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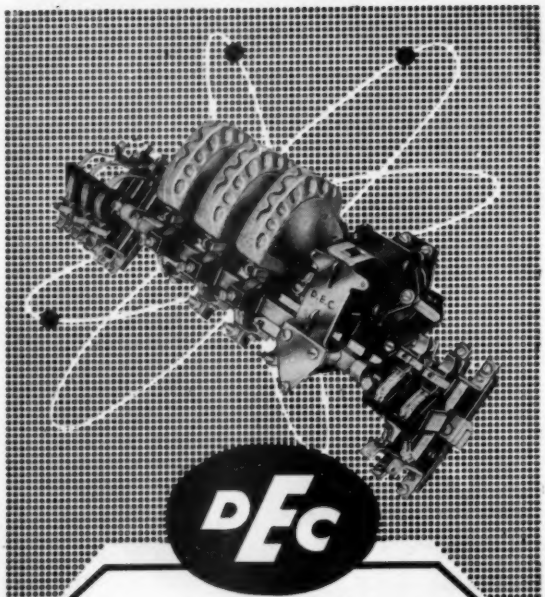

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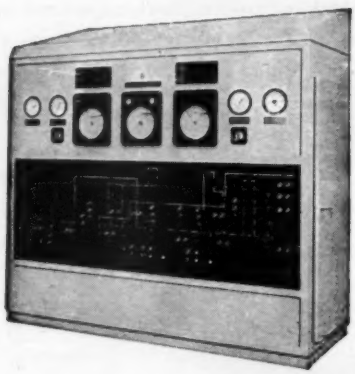

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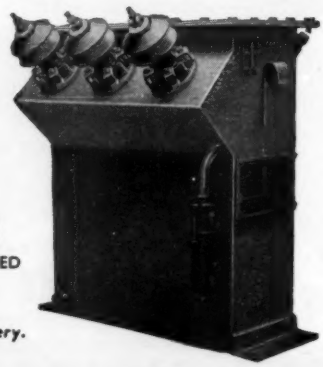

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NO LADDERS REQUIRED

Telescopic appliance for fixing and removing electric bulbs. Any reasonable height can be reached.
Made of Aluminium and can be carried with ease on any cycle.

STANDARD MODEL
for 60 to 200 watt lamps at 16' 6" from ground. 6' 0" closed. 12' 0" extended. Weight 3 lb. Cycle clips and Extension Tubing supplied.

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for 200 to 500 watt lamps E.S. Caps at 20' 0" from ground. 7' 0" closed. 16' 6" extended. Weight 5½ lb. Cycle clips and Extension Tubing supplied.

Used by the leading corporation and electric light companies throughout the world.
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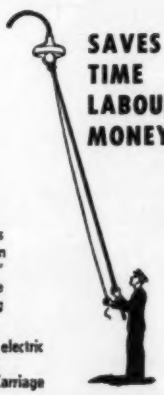

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All these aircraft carry or will carry equipment incorporating

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SILICON RECTIFIERS

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SenTerCel silicon rectifiers are readily available from stock and from production. They are being used in increasing quantities in Services and civilian electronic equipment.

Ask for Technical Data Sheets F/SIL. 101 and F/SIL. 102 which give full electrical and mechanical information concerning *SenTerCel* silicon rectifiers AVAILABLE FROM STOCK AND FROM PRODUCTION.

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BY APPOINTMENT TO HER MAJESTY THE QUEEN MANUFACTURERS OF ELECTRIC LAMPS

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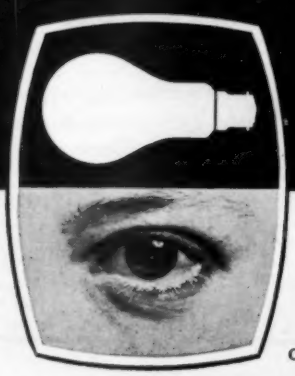
Keep selling Crompton lamps, January, February, all the year round. With a nationwide television campaign still fresh in people's minds, with powerful national press advertising in full force now, Crompton lamp sales are going in one direction—up! Your profits can go with them.

Just a reminder! People are always needing lamps, but they forget. Have you still got the striking Crompton showcards, mobiles, and self-service aids? It's worth making sure they're seen.

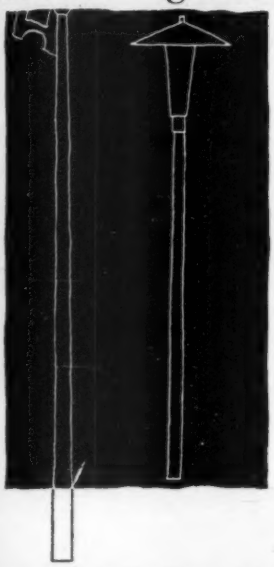


—you'll SEE why!

CROMPTON PARKINSON LTD., CROMPTON HOUSE, ALDWYCH, LONDON, W.C.2

THE NEW HORSTMANN TYPE 'K' MK II TIME SWITCH

provides light on time at lower cost



The new type "K" Mark II Time Switch meets the demand for a simple synchronous motor driven switch, low in cost yet accurate and reliable in use.

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The standard movement is suitable for use on 200/250 volts 50 cycles time controlled frequency; units for most other voltages and frequencies can be supplied to order.

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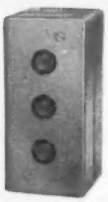

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Used in Type 'D' and 'DMC' units. Basic characteristics as Type 'US' unit.

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DP12

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PATT. No. 12262

WITH this bridge D.C. resistance may be measured quickly and accurately from 0·000001 to 10 ohms. The accuracy is not seriously affected by contact resistance between bridge and test piece or by fluctuations in supply current.

The resistance value is read on two dials, one of ten 0·01 ohm steps, the other of 0·012 ohms continuously variable—one scale division representing 0·0001 ohm. This range is extended by a seven position multiplying switch.

Pattern No. 12262 A. With multipliers X10, X5, X1, X0·5, X0·1, X·05, X·01. Overall range 0·000001 to 1 ohm.

Pattern No. 12262 B. With multipliers X100, X50, X10, X5, X1, X0·5, X0·1. Overall range 0·00001 to 10 ohms.

These models include a taut suspension reflecting galvanometer with sensitivity control, and a two-dial current control with ammeter. The maximum current rating is 25 amperes continuous.

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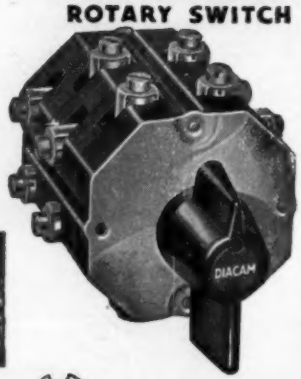
THE VERSATILE DIACAM ROTARY SWITCH

This 30-amp. rotary switch has solid silver contacts and a double-break on each pole, ensuring maximum efficiency and absolute safety under all conditions. Available in most sequences for either single or multi-pole switching.



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The Drummond Low Voltage Lighting Transformer ensures that safe and efficient lighting can be provided in workshops.
The transformer and switch fuse unit in the lid is self isolating, thus giving complete safety on inspecting and changing fuses. Interservices H.R.C. fuses are provided in both primary and secondary circuits and a slow break D.P. ON-OFF switch is incorporated in fuse unit.
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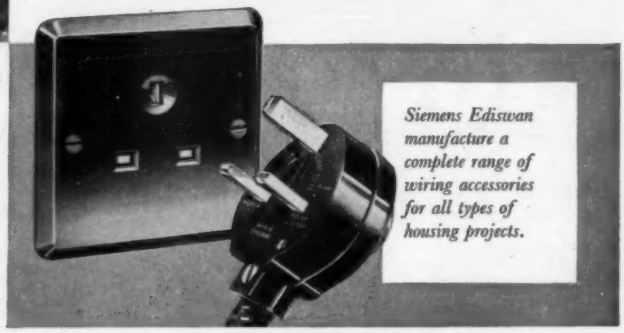

Siemens Ediswan manufacture a complete range of wiring accessories for all types of housing projects.

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18/1

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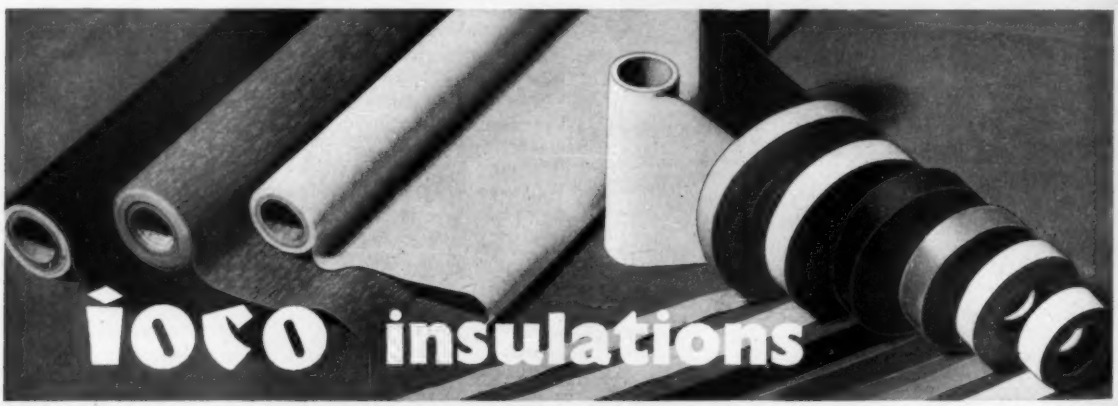

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LINAPEX. Varnished fabrics and tapes for cable and general electrical insulations.

SILOPLAST. Silicone rubber coated glass fabric and tapes for high temperature insulation.

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FOILEX. Flexible synthetic resin treated copper and aluminium for printed circuit production.

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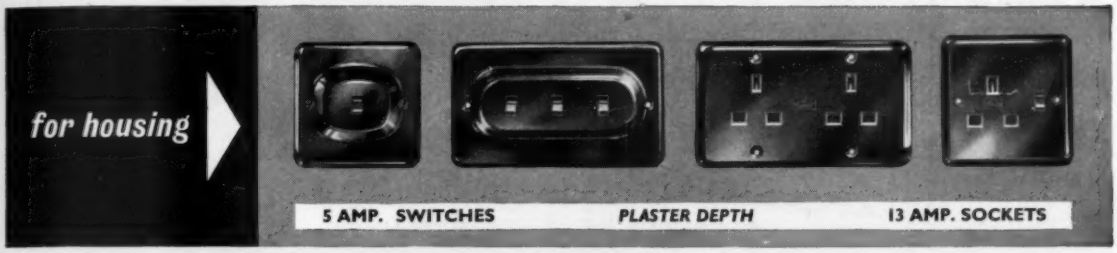

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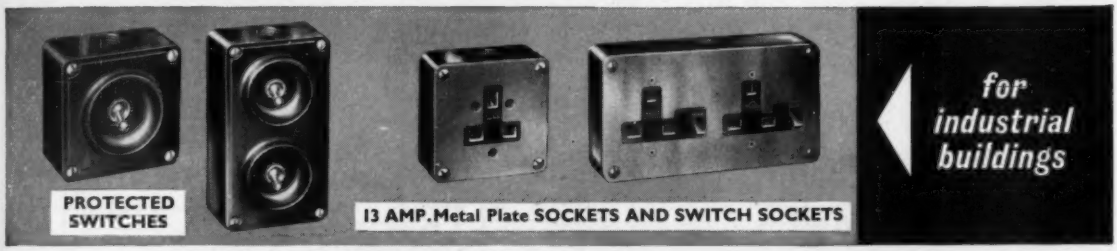

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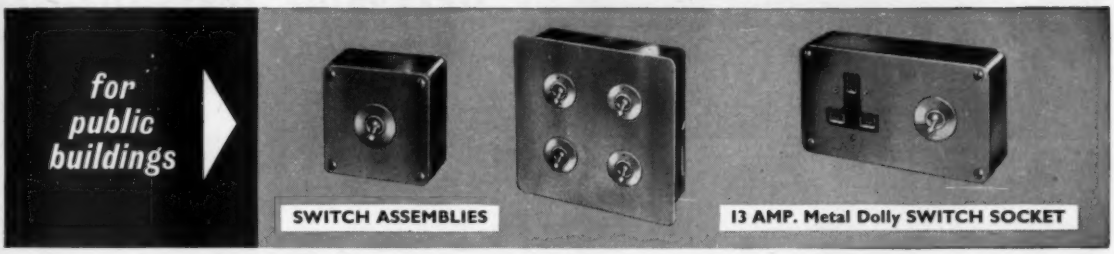
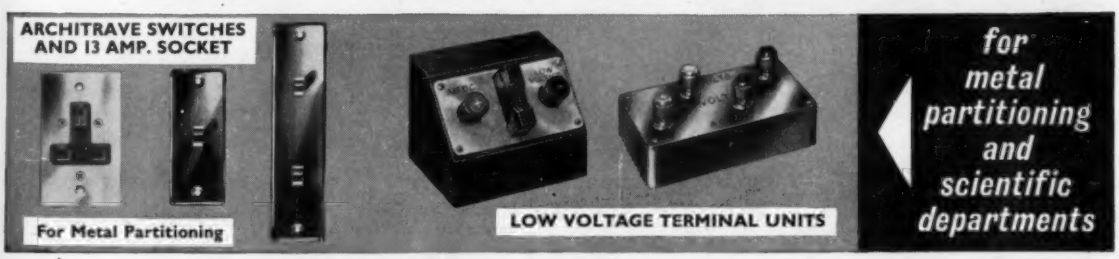


... approved by Contractors everywhere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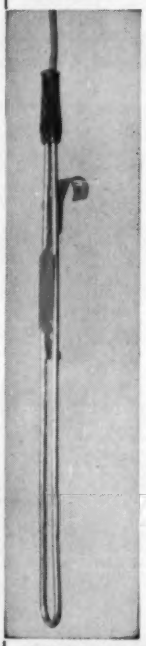

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PRICE
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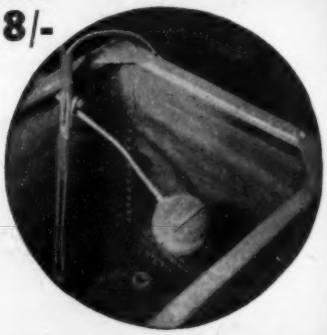

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the first choice for reliability

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We can supply Meters with Non-Standard Ranges in Current, Volts or Ohms. To B.S. 89. Industrial or Precision Grade accuracy.

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Fluvent Cubicle Type Switchboard recently supplied to British Crepe Ltd.

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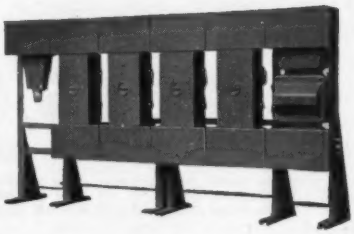
Energy Distribution for today's conditions demands fresh approaches. The examples illustrated are typical contributions by us to meet individual needs of widely different character.



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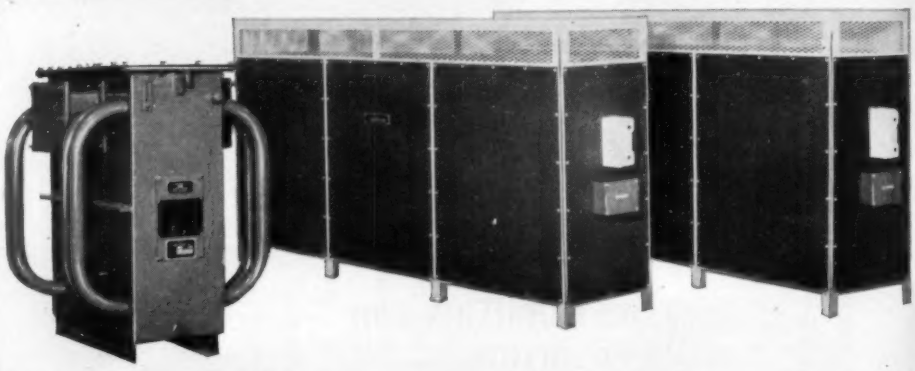
in rectifier equipment

you need *G.E.C.* reliability



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G.E.C. manufactures rectifier equipment to suit the needs of every industry.

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OFFICIAL NOTICES, TENDERS, ETC.

COUNTY BOROUGH OF WIGAN

Street Lighting Schemes, 1958/59

TENDERS are invited for the supply of the undermentioned equipment :—

A. 53 Side Entry Difractor Lanterns, complete with 250-watt mercury discharge lamps.
B. 53 Solid Filled Chokes and Condensers for use with the above lanterns and lamps (Item A).
C. 53 25-ft. mounting height Group A Concrete Columns of various outreaches suitable for side entry lanterns.
D. 377 Top Entry Difractor Lanterns complete with dome refractors and 80-watt mercury discharge lamps.
E. 377 Solid Filled Chokes and Condensers for use with the above lanterns and lamps (Item D).
F. 377 15-ft. mounting height Group B type Concrete Columns suitable for top entry lanterns.
G. 3,000 lin. yds. Twin 3.029 T.R.S. Cable with E.C.C.

Forms of tender may be obtained upon application to the Borough Engineer, Municipal Buildings, Hewlett Street, Wigan.

Tenders in plain sealed envelopes, endorsed "Tenders for Street Lighting," must be received by the undersigned not later than 12 noon on Friday, the 7th of March, 1958.

The Corporation do not bind themselves to accept the lowest or any tender.

ALLAN ROYLE,
Town Clerk.
Municipal Buildings,
Hewlett Street, Wigan. 2338

BOROUGH OF SPENBOROUGH

Installation of Group "A" Sodium Street Lighting on the Leeds-Halifax-Burnley Trunk Road A.58

TENDERS are invited for the supply and erection of 43 Pre-stressed Concrete Columns complete with Lanterns, Lamps, Control Gear and Wiring. Tender documents from Borough Engineer on payment of £2 2s. (refunded on receipt of a bona fide tender).

Tenders, in plain envelopes endorsed "Trunk Road Lighting A.58," to the undersigned not later than 24th February, 1958.

The Corporation do not bind themselves to accept the lowest or any tender.

D. COUPE,
Town Clerk.
Spenborough Town Hall,
Cleckheaton.
3rd February, 1958. 2355

METROPOLITAN BOROUGH OF WANDSWORTH

Electrical Works

APPLICATIONS invited from those who desire to have their names placed on the Council's list of electrical contractors who may be invited to submit quotations from time to time for the execution of electrical installation works.

Applications by letter giving names of two technical and one financial referee to reach me by 28th February, 1958.

R. H. JERMAN,
Town Clerk.
Municipal Buildings,
Wandsworth,
London, S.W.18. 2339

BOROUGH OF COLWYN BAY

Trunk Road A.55 : Lighting

Section 3: Cefn Road to Highlands Road
Section 5: Brompton Avenue to Station Road, Mochdre

TENDERS are invited for the following works required in the lighting of approximately 2.1 miles of Trunk Road in the Borough :—

1. The provision and erection of Class A Lighting Columns.
2. The provision and fixing of Lanterns, Control Gear and other equipment.
3. The provision and laying of Lighting Cable (approx. 2,100 yds.).

Separate tenders will be considered for Items 1, 2 and 3 or for the whole of the works.

Plans may be inspected and copies of the tender documents obtained upon application to Mr. H. Wilman, A.M.I.C.E., Borough Engineer and Surveyor, Whalley Range, Lansdowne Rd., Colwyn Bay.

Tenders in plain sealed envelopes, "Trunk Road Lighting, Sections 3 and 5," must be delivered to the undersigned not later than 12 noon on Thursday, 20th February, 1958.

The Council does not undertake to accept the lowest or any tender.

HAROLD E. BRAITHWAITE,
Town Clerk.
Town Hall, Colwyn Bay.
27th January, 1958. 2243

HEREFORDSHIRE HOSPITAL MANAGEMENT COMMITTEE

Burghill Hospital

TENDERS are invited for the complete Electrical Rewiring of 13 Estate Houses. Form of tender, specification and conditions of contract can be obtained from the Superintendent Engineer, Burghill Hospital, Hereford.

Sealed tenders to be received not later than first post Tuesday, 11th March, 1958, in the addressed envelope provided.

A. D. EDMUNDS,
Group Secretary.
Victoria House,
Eign Street, Hereford. 2373

COUNTY BOROUGH OF BIRKENHEAD

Works and Buildings Department

TENDERS are invited for the supply of ELECTRIC LAMPS during the twelve months ending 31st March, 1959.

Form of tender from the Manager, Works and Buildings Department, 300, Cleveland Street, Birkenhead.

Closing date for tenders, 28th February, 1958. 2378

SITUATIONS VACANT

ASTRAL SWITCHGEAR LIMITED

EXTENSION of sales organisation means the following appointments are shortly to be made :—

TECHNICAL SALES REPRESENTATIVE London Area. Experience of medium/light engineering in L.V. switchgear and allied fields is necessary; experience in negotiating with industrial users, consultants, etc., desirable.

TECHNICAL SALES REPRESENTATIVE Midlands Area. Experience generally as above.

Remuneration includes pension and life assurance scheme; car and expenses provided.

Please write giving full details to General Manager, Alma Road, Enfield. 2331

CENTRAL ELECTRICITY GENERATING BOARD

Electronic Digital Computing Staff, System Planning Branch

APPLICATIONS are invited for the following appointments for the electronic digital computing service within the System Planning Branch of the Chief Engineer's Department, Headquarters, Bankside House, London, S.E.1.

COMPUTER ENGINEER (ER/45).

To take charge of the day to day working of the computing section. The post calls for ability to discuss computer applications with engineers and other potential users in the electricity supply industry and to expose the essentials of a problem to programming staff. For this reason, experience of the electricity supply industry and a sound knowledge of digital computing techniques is essential. Corporate Membership of the Institution of Electrical Engineers or equivalent qualifications would be considered an advantage.

Salary £1,435-£1,795 per annum.

ANALYTICAL AND STATISTICAL MATHEMATICIANS (ER/46).

This section will provide a consultant service to the computer programming staff and carry out statistical and analytical investigations into problems associated with long term forecasts including the growth of electricity demand and the related requirements in terms of new generating and transmission plant to provide for the optimum growth of the system as a whole. A high degree of mathematical ability is required and applicants should possess a good degree in mathematics or statistics with subsequent experience in industry. The successful applicant for the senior post (Grade 1) will be expected to co-ordinate the work of the section and carry out mathematical research and to develop new techniques for dealing with system planning problems.

Salaries Grade 1, £1,435-£1,795 per annum.
Grade 2, £1,210-£1,570 per annum.

PROGRAMMERS (ER/47).

To deal with the solution by digital computer of a variety of problems mainly associated with the electricity supply industry. Previous experience in numerical analysis and the use of electronic digital computers would be considered an advantage, but is not essential. Applicants should hold a University Degree in mathematics or its equivalent and be interested in the study of engineering systems.

Salaries £1,210-£1,570 or £1,105-£1,315 according to qualifications and experience.

COMPUTER MAINTENANCE ENGINEERS (ER/48).

To undertake the servicing and maintenance of electronic and other equipment associated with a digital computer establishment. Previous experience on computer maintenance is not essential and successful candidates will be required to undertake a course of instruction at the computer manufacturer's works. A knowledge of computer design or of pulse techniques, as applied to radar, would be considered an advantage. Applicants should possess qualifications leading to Graduate Membership of the Institution of Electrical Engineers.

Salaries £1,105-£1,315 or £870-£1,045 per annum according to qualifications and experience.

Applications, stating age, qualifications, experience, present position and salary and also quoting specific vacancy number, should be forwarded under confidential cover to I. G. Ellis, Personnel Officer, 24/30, Holborn, London, E.C.1, by 26th February. 2381

Situations Vacant (continued)

YORKSHIRE ELECTRICITY BOARD

No. 6 (Hull) Sub-Area

SECOND ASSISTANT ENGINEER (Distribution Design).

Applicants should be Corporate Members of the Institution of Electrical Engineers or hold equivalent qualifications, and have had experience in planning extensions of distribution systems operating at 11 kV and below, together with the preparation of the relevant technical reports and estimates. They should also have had practical experience in the construction, operation and maintenance of H.V. and M.V. distribution systems. Experience of similar work on systems operating up to and including 66 kV would be an advantage.

Salary N.J.B. Class K, Grade 7, £1,160/£25/£1,235 per annum.

SECOND ASSISTANT ENGINEER (Operation and Maintenance).

Applicants should have experience in the operation and maintenance of equipment at voltages up to 66 kV on both underground and overhead systems.

Applicants should be Corporate Members of the Institution of Electrical Engineers or hold equivalent qualifications. The successful applicant will be required to assist in all matters affecting the operation and maintenance of the Sub-Area network.

Salary N.J.B. Class K, Grade 7, £1,160/£25/£1,235 per annum.

THIRD ASSISTANT ENGINEER (Distribution Design).

Applicants should be Graduate Members of the Institution of Electrical Engineers or hold equivalent qualifications, and have had experience in the design, construction, operation and maintenance of H.V. and L.V. underground and overhead distribution systems, substation plant and ancillary equipment.

Salary N.J.B. Class K, Grade 10, £935/£20/£995 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Hull, not later than 28th February, 1958.

No. 1 (Bradford) Sub-Area

THIRD ASSISTANT ENGINEER (Distribution Design).

Applicants should possess technical qualifications equivalent to those for Corporate Membership of the Institution of Electrical Engineers and have experience in the planning, design and estimating of medium and high voltage overhead and underground distribution systems. Experience in the construction and maintenance of such systems would be an advantage.

Salary N.J.B. Class K, Grade 10, £935/£20/£995 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 1 (Bradford) Sub-Area, Yorkshire Electricity Board, 45/53, Sunbridge Road, Bradford, not later than 28th February, 1958. 2399

INSTRUMENT ENGINEER

required by large oil company for work in Middle East. Applicants should have served a full apprenticeship and possess H.N.C.

The man selected will be required to calibrate and repair all types of electrical instruments governing the generation of electricity and the protection of circuits, both single and three-phase, including protective relays of all types, kilowatt indicators, kilowatt hour meters, kilovar indicators, power factor indicators, voltage regulators and frequency meters. In addition he would be responsible for the calibration and repair of test equipment such as A.V.O.s, Meggers, Selectest, etc.

Service will be on three-year contracts with pensionable pay not less than £1,185 per annum plus large local allowance. Paid home leave with free passages every two years. Fully furnished air-conditioned quarters at nominal rental. Bachelor preferred owing to shortage of married accommodation. Age limit 35.

Write giving full details, quoting No. 751, to Box No. 1484, c/o Charles Barker & Sons Ltd., Gateway House, London, E.C.4. 2364

SOUTH OF SCOTLAND ELECTRICITY BOARD

Lanarkshire Area

(1) First Assistant District Engineer (Coatbridge District)

(2) Third Assistant Engineer (Test), Area Transformer and Protection Test Department at Motherwell

APPLICATIONS are invited for the undernoted appointments. The salary and conditions of service for each of these appointments will be in accordance with the National Joint Board Agreement, Schedule A; the present classification and grading being as given below. Both of these posts are superannuable, subject to satisfactory evidence of health.

(1) FIRST ASSISTANT DISTRICT ENGINEER (Coatbridge District).

Applicants should preferably be Corporate Members of the Institution of Electrical Engineers or hold equivalent qualifications. They should have had a sound engineering training with subsequent experience in the maintenance and operation of H.V. and L.V. switchgear, together with experience in H.V. and L.V. fault location. They should also be conversant with the preparation of load flow diagrams, voltage drop and short circuit calculations. The classification and grading is F.4, salary £1,065/£1,140 per annum.

The successful applicant will require to reside within a reasonable distance of the District Offices at Coatbridge and to take part in standby duty in accordance with the above agreement.

(2) THIRD ASSISTANT ENGINEER (Test), Area Transformer and Protection Test Department at Motherwell.

Candidates should be Graduate Members of the Institution of Electrical Engineers or hold equivalent qualifications. They should have had a sound engineering training with subsequent experience in the testing of power transformers and modern protective equipment on a large distribution system. They should be conversant with the preparation of load flow diagrams, voltage drop and short circuit calculations. The classification and grading is L.10, salary £995/£1,055 per annum.

The successful candidate will require to reside within a reasonable distance of the Transformer Testing Station at Motherwell.

Application forms, which may be obtained from the undersigned, should be forwarded to this office within 14 days of the date of this advertisement.

DUGALD SMITH,
Manager.

137, Almada Street,
Hamilton. 2391

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

APPLICATIONS are invited for the following superannuable positions in the Testing Efficiency and Combustion Section of the Generation (Operation) Department, Divisional Headquarters. Conditions of service in accordance with the N.J.B. Agreement.

THIRD ASSISTANT ENGINEER (Vacancy No. 10/ER/58).

Qualifications leading to Corporate Membership of the Institution of Mechanical Engineers and/or the Institution of Electrical Engineers desirable.

Candidates should have experience in carrying out acceptance and routine tests on generating plant; investigation of operation difficulties and improving plant performance; standardisation and calibration of test instruments.

Salary Class AX/DX, Grade 6, £895 × £25 to £1,020/£1,110 per annum.

FOURTH ASSISTANT ENGINEERS (Vacancy No. 11/ER/58).

Higher National Certificate in Mechanical Engineering or equivalent qualifications desirable. Previous experience of power plant operation and testing and knowledge of instruments will be an advantage.

Salary Class AX/DX, Grade 8, £710 × £25 to £835/£910 per annum.

Application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Road, Gabalfa, Cardiff, to be returned by 28th February, 1958. 2356

SOUTH EASTERN ELECTRICITY BOARD

CARTOGRAPHIC DRAUGHTSMAN, Dorking and Epsom District.

Salary £500 × £20 to £600 per annum under Grade 1 of the N.J.C. Agreement. Superannuable.

Applicants should have experience in the preparation of mains record plans, reproduction of Ordnance Survey maps and general drawing office routine.

Applications, naming two referees, to C. L. B. White, District Manager, SEEBOARD, 56, South Street, Dorking, by 26th February, 1958.

FIRST ASSISTANT DISTRICT ENGINEER, Dorking and Epsom District.

Salary £995 × £20 to £1,055 per annum under N.J.B. Class F, Grade 5. Superannuable.

Applicants should be of Higher National Certificate standard and preferably Corporate Members of the I.E.E. They should have had responsible practice in the planning, construction, operation and maintenance of underground and overhead systems up to 33 kV in both urban and rural areas. The ability to control staff and organise work is essential.

Applications naming 2 referees on forms from C. L. B. White, District Manager, SEEBOARD, 56, South Street, Dorking, by 26th February, 1958.

ASSISTANT DISTRICT ENGINEERS, SUTTON DISTRICT.

Class F, Grade 7. Salary £885 × £15 to £930 per annum, plus London allowance. Superannuable.

Applicants, preferably Corporate Members of the I.E.E., should have had responsible experience and practice in the planning, construction, operation and maintenance of underground and overhead distribution networks. Experience of distribution in thickly populated urban areas would be an advantage.

Class F, Grade 11. Salary £685 × £15 to £730 per annum, plus London allowance. Superannuble.

Applicants should possess the Higher National Certificate in Electrical Engineering and have had a thorough training in underground and overhead distribution systems.

Applications naming 2 referees on forms from W. B. Hayden, M.I.E.E., Sutton Manager, SEEBOARD, 52, High Street, Sutton, Surrey, by 26th February, 1958.

A. L. BURNELL,
Secretary.

2397

GHANA PUBLIC SERVICE COMMISSION

APPLICATIONS are invited for the following vacancies in the Electricity Department :—

ELECTRICAL ENGINEERS to take charge of and assist in the operation or maintenance of electricity supplies of voltage up to 11,000 volts. Must be A.M.I.E.E. or gained exemption from its examinations and must have had 5 years' professional experience in power generation, transmission and distribution and consumers' installation. Salary in range £1,180-£2,080 per annum according to age and experience.

SENIOR STATION ENGINEER for the erection of new or additional distribution schemes. Must have served a recognised apprenticeship of at least 5 years in mechanical or electrical engineering and have subsequently gained 8 years' practical experience, at least 5 years in supervisory capacity, (a) of the erection and commissioning of A.C. overhead and underground transmission and distribution substations, transformers and switchgear up to 11,000 volts, or (b) of compression ignition oil engines generating between 100 and 1,500 kW. Salary range £1,330-£1,680 per annum according to age and experience.

Appointments on contract/gratuity terms for one tour of 18-24 months with possible extension to two tours. Gratuity at rate of £12 10s. for each completed month of satisfactory service. Outfit allowance £30-£60 on first appointment and education allowance for children when not resident in Ghana of £100 a child for up to three children under 18 years. Free first class passages for officer, wife and up to three children under 18. Quarters at low rental. Generous home leave. Low income tax.

For further particulars and application form write, stating age, qualifications and experience, to the Director of Recruitment, Ghana High Commissioner's Office, 13, Belgrave Square, London, S.W.1. 2386

NYASALAND ELECTRICITY SUPPLY COMMISSION

APPLICATIONS are invited for the following posts :—

ELECTRICAL ENGINEER (Mains) (M2C/42628/EF).

The duties of the post include design of and preparation of detailed specifications for distribution schemes up to 33 kV, and supervision of construction by contract or direct labour, commissioning and maintenance of such schemes.

Candidates should possess university degree or equivalent and/or at least Graduate Membership of I.E.E.

Salary in scale £1,000 × £50 to £1,650 × £50 to £1,950, according to qualifications and experience.

POWER STATION SHIFT CHARGE ENGINEER (M2C/42629/EF).

To take complete charge on shift of 7-MW coal-fired power station; steam conditions 400 lb./sq. in., 750° F. Board of Trade Certificate or equivalent would be a recommendation.

Salary in scale £1,000 × £50 to £1,650, according to qualifications and experience.

ELECTRICAL FITTER (M2C/42630/EF).

Applicants should have served an approved apprenticeship and have had experience with transformers, switchgear, motors and generators. A knowledge of cable jointing up to 11 kV would be an advantage.

Salary in scale £1,000 × £50 to £1,300, according to experience.

DIESEL FITTER (M2C/42631/EF).

Applicants should have served an approved apprenticeship and have had experience of installation, operation and maintenance of small and medium-size diesel generating sets. Operating experience of a small power house would be an advantage.

Salary in scale £1,000 × £50 to £1,300, according to experience.

OVERHEAD LINESMAN (M2C/42632/EF).

Applicants should have had experience of erection and maintenance of overhead lines and substations up to 33,000 volts.

Salary in scale £1,000 × £50 to £1,300, according to experience.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote the reference number shown against the post applied for. 2361

SOUTHERN ELECTRICITY BOARD

Assistant Engineer (Planning)

Salisbury District of No. 4 (Bournemouth) Sub-Area. Salary N.J.B. Class E, Grade 10 (£685 × £15 to £730 per annum). N.J.B. conditions of service.

The successful candidate will be required to assist the planning engineer in the preparation of schemes and estimates for extensions of and reinforcement to overhead and underground H.V. and L.V. networks. Applicants should have had sound experience in electricity supply distribution and the possession of suitable technical qualifications would be an advantage. The post will involve standby duties.

Applications on forms obtainable from the Sub-Area Secretary, 1, Priory Road, Bournemouth, and returned to him in envelopes suitably endorsed not later than 24th February, 1958.

Demonstrator

Swindon District of No. 2 (Newbury) Sub-Area. Salary N.J.C. Grade 1 (£500–£600 per annum. N.J.I.C. conditions of service.

Applicants should be qualified to advise generally on the utilisation of electric domestic appliances, to give public demonstrations of apparatus and to assist in showroom duties. The possession of an E.A.W. Certificate or equivalent Domestic Science qualification would be an advantage.

Applications on forms obtainable from the Sub-Area Secretary, 7, Oxford Road, Newbury, Berks., and returned to him in envelopes suitably endorsed not later than 24th February, 1958.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible. 2398

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:—

North Staffs Sub-Area

GENERAL ASSISTANT DISTRICT ENGINEER (Stone/Market Drayton District).

Applicants will be required to assist in all branches of distribution work, including construction, operation and maintenance of H.V./L.V. overhead and underground mains and substations. Technical qualifications desirable. Salary £635/£680 per annum (N.J.B. Grade E.11).

Apply by letter within 14 days, stating age, experience, present salary and position to Mr. H. A. P. Caddell, Sub-Area Manager, Midlands Electricity Board, 234, Victoria Road, Fenton, Stoke-on-Trent.

Wolverhampton and District Sub-Area

SECOND ASSISTANT DISTRICT ENGINEER (Walsall District).

Applicants should have had a sound technical training and wide experience in all branches of distribution work, including the construction, maintenance and operation of H.V. and L.V. mains and substations. Technical qualifications desirable. Salary £935/£995 per annum (N.J.B. Grade G.7).

Apply by letter within fourteen days, stating age, qualifications, experience, present position and salary, to Mr. D. Holt, Sub-Area Manager, Midlands Electricity Board, 83, Darlington Street, Wolverhampton.

Worcester and District Sub-Area

THIRD ASSISTANT DISTRICT COMMERCIAL ENGINEER (Worcester and Malvern District).

Applicants should have had experience in the installation and maintenance of street lighting equipment. The successful applicant will in addition be required to assist in all branches of the work undertaken by the District Commercial Department. Salary £740/£785 per annum (N.J.B. Grade F.10).

Applications stating age, experience, present position and salary should be forwarded within fourteen days, to Mr. R. Mallet, Sub-Area Manager, Midlands Electricity Board, Worcester and District Sub-Area, Whittington, Worcester.

A. STEPHENS,
Secretary.
2384

CENTRAL ELECTRICITY GENERATING BOARD

Southern Division

APPLICATIONS are invited for the following posts:—

SHIFT CHARGE ENGINEER, POOLE GENERATING STATION (S/13.986).

Applicants should possess technical qualifications admitting to corporate membership of a recognised professional institution, and have had previous operating experience involving responsibility in a large modern generating station with high temperatures and pressures and preferably with pulverised fuel equipment.

Salary N.J.B. Grade J.7, £1,065–£1,140.

GENERAL ASSISTANT ENGINEERS (S/13.987).

Applicants should have served an apprenticeship or had practical training suitable to the industry. They should possess a sound general and technical education and preference will be given to those possessing a Higher National Certificate (or those nearing completion of H.N.C. courses). Opportunities are available for general assistant engineers to complete their studies and gain wide experience with good prospects of promotion.

The duties of those appointed will vary, but will include as a general rule, the operation and control, under supervision, of generating plant. A number of these vacancies are at the oil-firing stations at Marchwood, Near Southampton, and Poole.

Vacancies also exist for those who wish to specialise in maintenance of electrical and mechanical generating plant, transmission lines, substations and cables, or generating station construction work.

Salary N.J.B. within scales £540–£730.

Special application forms, obtainable only from P. D. A. Oliver, Esq., Divisional Secretary, Central Electricity House, High Street, Portsmouth, should be returned by 26th February, 1958. 2383

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern Division

Appointment of Station Superintendent, Blyth "A" and "B" Power Stations

APPLICATIONS are invited for the appointment of STATION SUPERINTENDENT of the Blyth "A" and "B" Power Stations now under construction.

The first set of 120 MW is expected to be in commission in December, 1958, and the "A" Station completed by March, 1960. Completion of the first two sets of 275 MW each for the "B" Station is contemplated for 1963. The ultimate capacity of the "A" Station will be 480 MW and the "B" Station 1,100 MW, a total of 1,580 MW.

These power stations are situated on the north bank of the River Blyth at Cambois in Northumberland.

Applicants should have received a thorough technical and practical training followed by wide experience in the operation and maintenance of generating plant, and have also held positions of responsibility involving the control of technical engineering and administrative staffs. The successful applicant will be expected to reside within reasonable distance of the power station.

It is desirable that applicants should possess qualifications admitting to Corporate Membership of the Institution of Electrical Engineers and/or Institution of Mechanical Engineers.

The commencing salary for this appointment will be in accordance with Class D, Grade 5, £2,100–£2,300, rising to the maximum of £2,500 of Class E, Grade 5 of the Salary Schedule negotiated by the National Joint Managerial and Higher Executive Grades Committee, and the conditions of employment will be those agreed by that Committee.

Forms of application may be obtained from Divisional Establishments Officer, Central Electricity Generating Board, North Eastern Division, Carliol House, Newcastle upon Tyne, 1, to whom they should be returned to arrive not later than the 28th February, 1958. 2322

H.N.C. OR O.N.C.

TENDERING AND CONTRACTS ENGINEERING

with

'ENGLISH ELECTRIC' STAFFORD

WE wish to appoint a number of young Engineers in the following fields :—

MINING.
METAL INDUSTRIES.
INDUSTRIAL PLANT.
POWER TRANSFORMERS.
POWER SYSTEMS METERS AND RELAYS.
SWITCHGEAR.
RECTIFIERS.

There are openings for engineers with either the experience to continue or the ability to take up a career in this work.

A COURSE will be arranged for suitable people who have insufficient experience for direct employment.

These are all pensionable staff appointments. Please write indicating the field in which you have most interest to Dept. C.P.S., Marconi House, 336/7, Strand, London, W.C.2, quoting Ref. ER.1297L.

2326

SOUTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the position of ASSISTANT ENGINEER in District 344 (Merthyr) in the Central Sub-Area of the Board.

Salary Class F, Grade 8 (£835/£880) of the N.J.B. Agreement.

Applications stating age, present position and salary, qualifications, experience and three referees should be addressed to the Secretary (Establishments Section), St. Mellons, Cardiff, so as to reach him not later than Saturday, 22nd February, 1958. 2393

Situations Vacant (continued)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Kincardine Generating Station

APPLICATIONS are invited for the following superannuable appointments :—

(1) STATION SUPERINTENDENT (Ref. No. E1/58).

(2) DEPUTY STATION SUPERINTENDENT (Ref. No. E2/58).

The station, at present under construction, is situated on the Firth of Forth in Central Scotland, and will consist of 3 120-MW units followed by 2 200-MW units, giving an ultimate capacity of 760 MW. The units will be coal fired with reheat, having steam conditions of 1,500 p.s.i., 1,000° F for the 120-MW units and 2,350 p.s.i., 1,050° F for the 200-MW units.

Candidates should possess qualifications admitting to Corporate Membership of the Institution of Electrical Engineers and/or Institution of Mechanical Engineers.

Arrangements are being made to provide housing accommodation for the successful candidates.

The appointment of Station Superintendent will be in accordance with the National Joint Managerial and Higher Executive Salary Scale, commencing on Class C, Grade 5, £1,900/£2,100 per annum and ultimately rising to Class E, Grade 5, £2,300/£2,500 per annum.

The appointment of Deputy Station Superintendent will be in accordance with the National Joint Board Salary Scale, commencing on Class K, Grade 3, £1,560/£1,665 per annum and ultimately rising to Class M, Grade 3, £1,825/£1,945 per annum.

Apply, quoting appropriate reference number, on standard form AE6, available from the Secretary, P.O. Box 173, 351, Sauchiehall St., Glasgow, C.2, not later than Friday, 28th February, 1958. 2392

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments in the Northmet Sub-Area. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

HERTFORD DISTRICT, DEMONSTRATOR (Ref. 766) (17/58.R.).

Candidates should have had domestic science training, including electrical housecraft, and should preferably hold the E.A.W. Diploma. They should be competent to lecture and advise consumers on the utilisation of domestic electrical appliances and be able to give demonstrations with a sales emphasis. Previous experience in an electricity service centre is desirable.

Salary N.J.C. Grade 1 (£500-£600) although progress beyond £540 per annum will be subject to a certificate that the person concerned is capable of undertaking all the duties of the grade.

Apply by letter to W. H. Hatton-Ward, Assoc.I.E.E., Manager, Eastern Electricity Board, Bridgefoot, Ware, Herts, by 24th February, 1958.

ST. ALBANS DISTRICT (a) SALES REPRESENTATIVE, Hatfield Service Centre (Ref. 700) (18/58.R.); (b) SALES REPRESENTATIVE (Ref. 678) (19/58.R.).

The duties will be advising consumers on commercial matters associated with supply, tariffs and apparatus sales, in accordance with the N.J.C. agreement. The successful candidate for appointment (a) will be expected to assist with service centre work when required and to work the normal service centre hours.

Salary N.J.C. Grade 1 (£500-£600).

For these appointments apply by letter, to F. J. Drake, Assoc.I.E.E., Manager, Eastern Electricity Board, 107, St. Peter's Street, St. Albans, Herts, by 24th February, 1958. 2385

ELECTRICAL ENGINEERING DRAUGHTSMAN

ELECTRICAL ENGINEERING DRAUGHTSMAN required with sound experience in design of general installation and subsequent maintenance of H.T. substation and distribution in a large factory in North West. Application giving age and full details of experience and salary required, to—Box 2402.

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

APPLICATIONS are invited for the following appointments in this Division:—

GENERAL ASSISTANT ENGINEER (Shift Control Duties), NORTHAMPTON POWER STATION (Vacancy No. 21/58/ER).

Applicants should have served an apprenticeship or had practical training suitable to the industry and should possess a sound general and technical education. Possession of an Ordinary National Certificate in Electrical Engineering is a minimum requirement.

Salary will be within the range (£540-£680 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 19th February, 1958.

SHIFT CONTROL ENGINEER, NORTH WILFORD POWER STATION (Vacancy No. 24/58/ER).

Applicants should have had a sound training and practical experience in a modern power station. The possession of a Higher National Certificate, or its equivalent, will be an advantage.

Salary will be in accordance with Class K, Grade 10 (£935-£995 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 26th February, 1958.

These appointments will be pensionable under the terms of the Staff Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote vacancy number.

L. F. JEFFREY,
Divisional Controller.

5th February, 1958. 2357

INSTRUCTION BOOK WRITER

ENGLISH ELECTRIC

STAFFORD

THE company wishes to appoint a Technical Writer interested in the compilation of operating procedures and installation and maintenance instructions associated with POWER SYSTEM METERING AND RELAY EQUIPMENT.

Applicants should have a sound technical background, preferably in the light current manufacturing or operating fields. They should also have a flair for written expression.

Applications, which will be treated confidentially, should contain details of age, qualifications, experience, present position and status.

Please write to the Central Personnel Services, 336/7, Strand, London, W.C.2, quoting Reference ER.1292C.

2325

SOUTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the position of ASSISTANT ENGINEER (Substations) in District 347 (Cardiff East) in the Central Sub-Area of the Board.

Salary Class G, Grade 14 (£590/£635), plus 10% shift enhancement of the N.J.B. Agreement.

Applications stating age, present position and salary, qualifications, experience and three referees should be addressed to the Secretary (Establishments Section), St. Mellons, Cardiff, so as to reach him not later than Saturday, 22nd February, 1958. 2395

INSTRUMENT TRANSFORMER DESIGN ENGINEER FOR SOUTH AFRICA

APPLICATIONS are invited for the above position in Johannesburg from specialists preferably with B.Sc. or H.N.C. of an age between 30 to 35 years. Applicants should have a sound knowledge of design and manufacturing techniques for both current and voltage transformers to BSS 81 and 2046 up to the highest system voltages at present in use. A sound knowledge of impulse testing as applied to instrument transformers will be a recommendation.

The position carries a commencing salary according to qualifications and experience, of not less than £1,250 plus a substantial annual bonus and offers excellent prospects of advancement.

A single air passage repayable over a suggested contract period of three years will be provided for the successful applicant.

Housing presents no difficulties.

This position must be filled at the earliest possible date and applications which will be treated in confidence, giving age and full details of education, qualifications and experience, including recent testimonials, should be submitted by AIR MAIL without delay to the address below. Telephone numbers where applicants can be contacted at short notice should be given in order that a representative who will travel to Britain by air can arrange for interviews on arrival.

TRANSFORMER ENGINEER
P.O. BOX 10100
JOHANNESBURG, S.A. 9270

SARAWAK ELECTRICITY SUPPLY CO. LTD.

A RELIEF ENGINEER and a GENERATION ENGINEER are required by the Sarawak Electricity Supply Co. Ltd., a Sarawak Government-owned public utility company, for appointment on agreement for tour of three years in first instance, with prospects of renewal. Quarters, with hard furniture, provided at low rental. Free first class passages. Liberal leave on full salary. There is no local personal income tax in Sarawak at present.

RELIEF ENGINEER (M2C/42627/EF). Salary, according to qualifications and experience, in scale (including inducement pay and company's contributions to provident fund) equivalent to £1,638 rising to £2,180 a year. Candidates, aged 30 or over, should be Graduate or Corporate Members of I.E.E. or I.Mech.E., and have wide experience in erection of diesel power plant and distribution systems. They should be capable of controlling groups of power stations with their distribution systems, from 50 kW to 1,100 kW installed capacity.

GENERATION ENGINEER (M2C/42626/EF). Salary, according to qualifications and experience, in scale (including inducement pay and company's contributions to provident fund) equivalent to £1,318 rising to £1,864 a year. Candidates, aged 27 or over, must be Graduate or Corporate Members of I.E.E. or I.Mech.E., or possess First Class M.O.T. Marine Engineer's Certificate (Diesel) or equivalent qualification, and have wide experience in installation and maintenance of diesel power generating plant and associated equipment.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote reference number shown against the post applied for. 2319

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

RECORDS DRAUGHTSMAN required in the North Wirral District at Birkenhead. Salary £500/£600 per annum (N.J.C. Grade 1).

Applicants should have had drawing office experience and be able to prepare, from information obtained on site, records of overhead lines, underground cables and substation layouts.

Appointment subject to medical examination. Pension scheme.

Applications, on forms obtainable from the Manager, No. 3 Sub-Area, Electricity House, Newgate Street, Chester, must be forwarded not later than 24th February, 1958. 2400

CENTRAL ELECTRICITY GENERATING BOARD

SECOND AND THIRD ASSISTANT ENGINEERS (Mechanical and Electrical) required in the PRODUCTION, INSPECTION AND TEST SUB-BRANCH.

The Sub-Branch of the Chief Engineer's Department is concerned with the production, inspection and test in manufacturers' works of mechanical and electrical plant and equipment required for generation (including nuclear) and transmission purposes. The selected candidates will be based at any one of the Regional Offices which are situated in London, Birmingham, Derby, Manchester, Leeds, Newcastle and Glasgow.

Candidates for Second Assistant Engineer should preferably be Associate Members of the Institutions of Mechanical or Electrical Engineers, and for Third Assistant Engineer have qualifications equivalent to Graduate Membership of such institutions. Recent experience of production, inspection and test of mechanical or electrical plant in manufacturers' works is essential.

Salaries :—

Second Assistant Engineer, £1,160-£1,510.
Third Assistant Engineer, £1,055-£1,265.

Applications stating age, qualifications, experience, present position and salary to I. G. Ellis, Personnel Officer, 24/30, Holborn, London, E.C.1, by 27th February. Envelopes should be marked "Confidential," quoting reference ER/41. 2380

IMPERIAL CHEMICAL INDUSTRIES LIMITED

Wilton Works, Middlesbrough

has vacancies for

ASSISTANT TECHNICAL OFFICERS FOR ENGINEERING DESIGN

THE scene of Britain's largest chemical project, Wilton Works, is on a 2,000-acre site near the Cleveland Hills. Development consists of building plants which embody the most up-to-date designs of building, civil engineering and mechanical engineering, including a complete power station. It also includes electrical engineering in a wide variety covering the generation, distribution, power and lighting installations.

Applications are invited from men who possess Higher National Certificate or its equivalent who are interested in

ELECTRICAL DESIGNING.

After joining the staff, married men receive a reasonable refund of removal and travel expenses, and facilities are available in approved cases for substantial loans for house purchase; legal charges will also be advanced. A lodging allowance will be paid to married men selected, whilst they are maintaining two homes.

Please write to me: Staff Manager, Imperial Chemical Industries Limited, Wilton Works, Middlesbrough, Yorkshire, quoting reference 462/6.

2375

CENTRAL ELECTRICITY GENERATING BOARD

Yorkshire Division

APPLICATIONS are invited for an appointment as FOURTH ASSISTANT ENGINEER in the Technical Department based on Keadby, Nr. Scunthorpe.

Commencing salary within the range £710-£835 per annum, Class AX, Grade 8, according to qualifications and experience, rising to an ultimate maximum of £935 per annum (Class EX).

Applicants should possess technical qualifications leading to Corporate Membership of the Institution of Electrical Engineers and should have had some experience of protective equipments applied to high voltage generation and transmission systems. Works experience will be an advantage.

Application forms obtainable from the Divisional Secretary (Establishments), Central Electricity House, St. Mary's Road, Leeds, 7, to be returned within 10 days of the appearance of this advertisement. 2382

SOUTHERN RHODESIA ELECTRICITY SUPPLY COMMISSION

Assistant Engineer II, Transmission

A VACANCY exists for an experienced qualified engineer in the Commission's Transmission Section at the Head Office in Salisbury.

The transmission section is expanding rapidly and comprises over 7,000 miles of line including approximately 1,200 miles of line operating at between 33 kV and 88 kV.

Applicants (under 45) should be in possession of a B.Sc.(Eng.) degree and have had at least five years' experience with responsibility in one or more of the following:—

(1) Design and construction of transmission lines including supervision of construction staff and surveyors.
(2) Engineering and supervision of large switchgear and transformer installation including control gear, protective equipment and cabling.
(3) Design and construction of high voltage outdoor substations and switching stations.

The successful applicant will commence in Grade II at a gross salary of £1,650 p.a. within the scale £1,650 p.a. by increments to £1,800 p.a. with prospects of promotion to Grade I depending on ability.

The above salary includes a cost-of-living allowance at present 17½% of basic salary and where applicable a child allowance is paid.

Applications stating age, marital status, qualifications and experience to Secretary (R/ESC), Rhodesia House, 429, Strand, London, W.C.2, by 1st March. 2296

HIGH-VOLTAGE RESEARCH

SEVERAL GRADUATES IN ELECTRICAL ENGINEERING or PHYSICS, or holders of the H.N.C. in Electrical Engineering, are required in a HIGH-VOLTAGE RESEARCH LABORATORY for experimental research on HIGH-VOLTAGE PROBLEMS associated with surge diverters and other products of the company. The work covers a wide range and includes the construction and use of impulse voltage and impulse current generators, high direct voltage generators and electronic equipment.

Candidates should be able to carry out investigations without close supervision.

Previous works training and laboratory experience are desirable.

The appointments are permanent and pensionable; and starting salary will be in accordance with qualifications.

Applications, quoting reference Q.10, giving details of age, qualifications and experience, should be made to :—

Personnel Manager
METROPOLITAN-VICKERS ELECTRICAL CO. LTD.
Trafford Park, Manchester, 17

2324

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

FOURTH ASSISTANT ENGINEER is required in the Meaford Section of the Transmission Department located at Meaford, Nr. Stone. N.J.B. service conditions, superannuable appointment, salary within Schedule B, Grade 8, commencing in range £710-£835 and ultimately rising to £935 per annum.

Applicants should possess Higher National Certificate in Electrical Engineering or an equivalent qualification and should have had some experience in the operation and maintenance of high voltage transmission lines and substations.

Apply quoting vacancy number 736MD, on form AE6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 27th February, 1958. 2414

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

APPLICATIONS are invited for the following appointment in this Division :—

GENERAL ASSISTANT ENGINEER (Chemist),
DRAKELOW POWER STATION
(Vacancy No. 28/58/ER).

Applicants should have had a sound technical training and some previous laboratory experience and should hold the Ordinary National Certificate in Chemistry.

Salary will be within the range £540-£680 per annum, in accordance with the National Joint Board Agreement.

Closing date for receipt of applications, 26th February, 1958.

This appointment will be pensionable under the terms of the Staff Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote vacancy number.

L. F. JEFFREY,
Divisional Controller.
6th February, 1958. 2374

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern Division

Steam Testing Department

APPLICATIONS are invited for the appointment of a SECOND ASSISTANT ENGINEER in the Steam Testing Department with headquarters at Dunston to control a small section investigating the thermal performance and operating characteristics of a wide variety of modern steam plant.

The work calls for considerable initiative and offers experience of testing techniques in an interesting field. A knowledge of power station operation will be considered an advantage.

Applicants should be Corporate Members of the Institution of Mechanical or Electrical Engineers and should have previous plant testing experience.

The salary for the appointment will be in accordance with the National Joint Board Agreement, Schedule B, Grade 4 (£1,145-£1,375) and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from Divisional Establishments Officer, Central Electricity Generating Board, North Eastern Division, Carliol House, Newcastle upon Tyne, to whom they should be returned to arrive not later than 3rd March, 1958. 2342

BRADFORD EDUCATION COMMITTEE

Technical College

APPLICATIONS are invited for the following posts :—

LECTURER in Electrical Engineering.

ASSISTANT LECTURER Grade A in Electrical Installation Work.

Salary scales, in accordance with the Burnham Technical Award, are as follows :—

Lecturer, £1,200-£1,350 per annum. Previous industrial or research experience may be taken into account in fixing the commencing salary.

Assistant Lecturer Grade A, £475-£900 plus additions for training and graduate status. The commencing salary will depend on qualifications and experience and may be increased up to a maximum of twelve increments in respect of approved service in industry, commerce or in professional or research work.

Further particulars and application forms may be obtained from the Director of Education, Town Hall, Bradford, and completed forms should be returned to the Principal, Technical College, Bradford, 7, as soon as possible.

A. SPALDING,
Director of Education.
2362

Situations Vacant (continued)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Glasgow Area

Third Assistant Engineer, Construction

APPLICATIONS are invited to fill the above vacancy at Area Headquarters. Applicants should have a sound theoretical knowledge and practical training with experience in the erection and commissioning of E.H.V. switchgear, transformers and protective gear and general sub-station construction work.

The conditions of employment will be in accordance with the National Joint Board Agreement for the Electricity Supply Industry. The position is superannuable. Salary scale Class L, Grade 10, £995-£1,055 per annum.

The successful candidate will require to reside within reasonable distance of Area Headquarters.

Applications on the standard form, which may be obtained from the undersigned, should be completed and returned within twenty-one days of the appearance of this notice.

A. KELSO,
Manager.

P.O. Box 6,
75, Waterloo Street,
Glasgow, C.2.
6th February, 1958. 2390

LONDON ELECTRICITY BOARD

Senior Apprentices' Instructor

APPLICATIONS are invited for the above position at the Board's Training Centre located initially in Central London (near Ludgate Circus) and subsequently at Camden Town, N.W.1.

The successful applicant will be required to work under the Training Centre Supervisor, and he should have been a skilled craftsman with some previous experience in instructing. He should be capable of teaching any of the basic workshop skills with hand or machine tools. A knowledge of welding and of smithing would be an additional advantage. He will be responsible for assisting in the organisation of the Training Centre workshops and in co-ordinating the work of the other Apprentices' Instructors.

The post is graded under the National Joint Board Agreement; salary range £860/£1,085 per annum inclusive. The successful candidate will be required to work such hours as may be necessary in order to effectively supervise apprentices under instruction.

Application forms, obtainable from Personnel Officer, 46, New Broad Street, London, E.C.2, to be returned completed by 22nd February, 1958. Please quote ref. PER/2432/R. 2344

CENTRAL ELECTRICITY GENERATING BOARD

London Division

APPLICATIONS invited for following superannuable post. Conditions of service in accordance with N.J.B. Agreement, Schedule A. Salary includes London allowance. Qualifications entitling to Graduate Membership of I.E.E. or I.Mech.E. an advantage

ASSISTANT SHIFT CHARGE ENGINEER, WEST HAM POWER STATION
(Vacancy No. 58/90).

Sound practical and technical training necessary with practical experience in operation of power station plant. Salary Class H, Grade 9 = £935 plus £88 10s. shift p.a.

Applications, quoting vacancy number, to (or on form from) Central Electricity Generating Board, London Division, P.O. Box 136, London, W.1, by 24th February, 1958. 2359

SOUTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the position of COMMERCIAL ASSISTANT in District 461 (Pontypool) in the Eastern Sub-Area of the Board.

Salary Class F, Grade 10 (£740/£785) of the N.J.B. Agreement.

Applications stating age, present position and salary, qualifications, experience and three referees should be addressed to the Secretary (Establishments Section), St. Mellons, Cardiff, so as to reach him not later than Saturday, 22nd February, 1958. 2394

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern Division

Steam Testing Department: Ultrasonic Inspection Work

APPLICATIONS are invited for the appointment of FOURTH ASSISTANT ENGINEER in the Steam Testing Department with headquarters at Dunston Power Station for ultrasonic inspection duties in boilers, and to take part in test work of an investigational nature.

Applicants should preferably have a Higher National Certificate in Electrical Engineering and a knowledge of electronics would be an advantage.

The salary for the appointment (which is superannuable) will be in accordance with Grade 8, Schedule B of the National Joint Board Agreement (£710-£910 per annum) and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from Divisional Establishments Officer, Central Electricity Generating Board, North Eastern Division, Carliol House, Newcastle upon Tyne, to whom they should be returned to arrive not later than 28th February, 1958. 2321

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

No. 4 Sub-Area

APPLICATIONS are invited for the following appointments in the Conway Valley District:—

ASSISTANT SECTION ENGINEER, based on Llanrwst. Salary within range £740/£785 per annum (N.J.B. E.9).

ASSISTANT SECTION ENGINEER (Operation), based on Dolgarrog. Salary within range £740/£785 per annum (N.J.B. E.9).

Applicants should have had experience in the construction and operation of E.H.T., H.T. and L.T. overhead and underground distribution systems, including indoor and outdoor sub-station equipment. Technical qualifications desirable.

Appointments subject to medical examination. Pension scheme.

Application forms obtainable from the Manager, No. 4 Sub-Area, Electricity House, Rhostyllen, Nr. Wrexham. Closing date 19th February, 1958. 2320

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Aberdeen Area

APPLICATIONS for the following superannuable positions are invited from suitably qualified candidates:—

1. DISTRICT SENIOR COMMERCIAL ASSISTANT. N.J.C. Grade 5 (£855 × £25 to £930). Good experience of workshop procedure, required to supervise installation work, dealing with floor heating schemes, agricultural equipment and commercial application. Experience in stock control and handling.
2. SECOND ASSISTANT ENGINEER. N.J.B. G/6 (£995 × £20 to £1,055). Experience in planning of urban and rural networks is essential.

Forms of application may be obtained from the undersigned and must be returned before Monday, 24th February, 1958.

J. E. WHITTAKER,
Area Manager.

Area Offices,
Millburn Street, Aberdeen. 2360

SOUTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the position of ASSISTANT ENGINEER in District 347 (Cardiff East) in the Central Sub-Area of the Board.

Salary Class G, Grade 13 (£635/£680) of the N.J.B. Agreement.

Applications stating age, present position and salary, qualifications, experience and three referees should be addressed to the Secretary (Establishments Section), St. Mellons, Cardiff, so as to reach him not later than Saturday, 22nd February, 1958. 2396

RICHARD THOMAS & BALDWINS LTD.

Ebbw Vale Section, Monmouthshire

Electrical Engineering Department

APPLICATIONS are invited for the undermentioned appointments:—

(a) ELECTRICAL TEST ENGINEER.
(b) ELECTRICAL INSPECTORS.

Applicants should have a sound technical education, and have served a recognised apprenticeship in either:—

(1) Manufacture, or
(2) Industrial maintenance.

In addition, applicants must have experience of maintenance, installation, testing and commissioning of electrical plant, machinery and equipment, and possess a minimum qualification of O.N.C. or equivalent City and Guilds Certificate.

The positions are permanent, progressive and pensionable.

Applications, stating age, details of education and experience to the Chief Electrical Engineer. 2327

JOSEPH LUCAS (ELECTRICAL) LIMITED

Great King Street, Birmingham, 19

ENGINEER

EXPANSION of development of ignition equipment for gas turbines and allied projects creates a vacancy for a practical engineer with experience of design for economic production of electrical apparatus. The work is of a high technical standard and applicants should preferably possess an honours degree.

The post is permanent and pensionable and offers considerable scope for advancement to a progressive engineer.

Apply in writing stating age, qualifications and experience to the Personnel Manager, Joseph Lucas (Electrical) Ltd., Great King Street, Birmingham, 19, quoting reference PM/D/190.

128

CENTRAL ELECTRICITY GENERATING BOARD

South Western Division

Generation Construction Department

SENIOR DRAUGHTSMEN and ENGINEERING DRAUGHTSMEN.

Superannuation scheme. Salary N.J.B. Schedule D, Grade 5 or 6, £760-£860 or £595-£715 per annum.

Applicants should preferably have had experience in layout of mechanical equipment, or in layout and diagrams for electrical plant.

FOURTH ASSISTANT ENGINEER (Electrical).

Superannuation scheme. Salary N.J.B. Class AX/DX, Grade 8, £710-£835/£910.

Applicants should have had technical and practical training, with subsequent experience in the installation of electrical plant.

Applications on Form A.E.6/ACT obtainable from the Divisional Secretary, 26, Oakfield Road, Bristol, 8, should be completed and returned by 28th February, 1958. 2379

BRITISH STANDARDS INSTITUTION

AN ELECTRICAL ENGINEER is required by the British Standards Institution for work in connection with the approval of all types of electrical equipment for export to Canada and for other fields of work in connection with the investigation of electrical equipment. Applicant should have served an apprenticeship and have technical qualifications equivalent at least to Graduate Membership of I.E.E.

Salary £850 and upwards according to qualifications and experience.

Apply in writing to Establishment Officer, B.S.I., 2, Park Street, London, W.1. 2341

ELECTRICAL ENGINEER (DISTRIBUTION)

THE Operations Branch of the UNITED KINGDOM ATOMIC ENERGY AUTHORITY, Industrial Group, requires an ELECTRICAL ENGINEER at Dounreay Works, Thurso, Caithness, Scotland, to supervise the maintenance and control of E.H.T., H.T. and L.T. distribution and generating equipment.

A recognised electrical apprenticeship, Corporate Membership of the Institution of Electrical Engineers, or equivalent, and good experience of the maintenance and operation of high-rupturing capacity switchgear and associated protection gear are essential. Power plant experience would be an advantage.

Salary assessed within scale £1,300-£1,740. Contributory pension scheme.

A house at Thurso or hostel accommodation may be available. Substantial assistance towards removal expenses is given in certain cases.

Send POSTCARD for application form, quoting reference 2230, to Works Secretary, Dounreay Works.

Closing date 24th February, 1958. 2323

TECHNICAL SALES ENGINEERS

AS part of a scheme for extending their activities, the makers of electric motors and generators up to 300 kW require TECHNICAL SALES ENGINEERS to represent them in the West Midlands, North Midlands and Eastern England.

Appointments provide scope for men eager to sell first-class products. Qualifications in electrical engineering are desirable, but not as essential as practical experience with D.C. motors and generators.

Initial basic salary £900 to £1,200 per annum depending upon experience. Applications will be treated in the strictest confidence.

Write giving details of age, education, technical training and subsequent experience to Sales Manager, Mawdsley's Limited, Dursley, Gloucestershire.

2277

FORD MOTOR COMPANY LIMITED

APPLICATIONS are invited for the following vacancies :—

ASSISTANT ENGINEER IN CHARGE.

Experience in the efficient operation of turbo-alternators and large pulverised fuel-fired high-pressure boilers is required. A sound technical engineering training is essential. (Reference T.A.E.)

ENGINEERING ASSISTANT.

Applicants should be familiar with power station efficiency control and operating statistics. The duties will also include assessing the economics of plant development schemes associated with power production. (Reference T.E.P.)

Salary in accordance with experience and qualifications. Generous non-contributory pension scheme.

Please write to Training and Recruitment Department (012A), Ford Motor Company Ltd., Dagenham, Essex, giving details of age, experience and qualifications, and quoting appropriate reference. 2328

INTERNAL SALES ENGINEER

ELECTRICAL ENGINEER required to handle technical correspondence and orders in sales office of well-known instrument company. Knowledge of electrical instruments essential, and applicants must have a good standard of English. Pension scheme.

Please write fully to Personnel Officer, ELLIOTT BROS. (LONDON) LTD., Century Works, Conington Road, Lewisham, London, S.E.13.

2345

BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION

Industrial Electric Heating Engineer

APPLICATIONS are invited for the appointment of an engineer with general knowledge of the utilisation of electricity for heat treatment and process heating.

Candidates should have experience of various types of industrial electric heating equipment, including furnaces, resistance heaters and high frequency heaters, and of their practical application in factories and works. The possession of a University Degree in Science or Engineering will be an advantage, ability to read French and/or German desirable. Salary within range £1,435/£1,560, plus £50 London allowance, with starting point according to experience and qualifications. Pension scheme available.

Applications, stating age, qualifications and experience and salary required, should be addressed, by 21st February, 1958, to the Director and Secretary, British Electrical Development Association, 2, Savoy Hill, London, W.C.2. 2220

PETROCHEMICALS LIMITED

require a

SHIFT ELECTRICAL CONTROLLER

in their Power House.

Applicants should preferably be of O.N.C. (Electrical) standard with experience of A.C. generation and distribution, H.T. and L.T. switchgear and transformers with the usual protective systems. The duties include control of cooling water, compressed air and cooling tower pressure systems. The applicant should also have experience in the control of operating staff.

The salary with this position will be up to £800 per annum plus shift allowance.

Excellent working conditions exist and a voluntary contributory staff pension fund is in operation. Transport from most areas.

Applications giving full details of previous experience and qualifications should be addressed to the Industrial Relations Manager, Petrochemicals Ltd., Partington Industrial Estate, Urmston, Nr. Manchester, quoting ref. ENG/L70. 2246

VACANCIES, SHIFT ENGINEERS, TECHNICAL GRADE III
CENTRAL POWER STATION (WD) ALDERSHOT

PROVINCIAL salary scale £655 (at age 26) to £820 plus shift disturbance allowance of 6s. 6d. per shift.

QUALIFICATIONS: Ordinary National Certificate in Electrical or Mechanical Engineering or evidence of equivalent standard in technical education and 5 years' apprenticeship or equivalent with engineering concern giving good comprehensive training.

EXPERIENCE: After completing apprenticeship or equivalent, candidates to have had 3 years' experience in charge of operation and maintenance of steam, diesel electric generating plant and switchgear.

Applications with testimonials to C.E.E., Aldershot District, Central Power Station, Thornhill Road, Aldershot. 2297

AREA SALES ENGINEERS

SALES ENGINEERS of outstanding ability are required to promote the sale of industrial and domestic A.C. Electric Motors by direct personal contact with buyers in certain parts of the U.K.

The range of products is such that almost every motor application is catered for up to 600 h.p., thus ample opportunity is provided for experienced top-grade men.

Applications to :—

The Sales Manager
NEWMAN INDUSTRIES LIMITED
Yate, Bristol

2329

BRITISH KLOCKNER SWITCHGEAR LIMITED
Chertsey, Surrey

TECHNICAL SALES ENGINEERS required for London and Home Counties. Knowledge of motor control gear; sales experience preferred but not essential. Apply giving full particulars to—Managing Director. 166

CENTRAL ELECTRICITY GENERATING BOARD

London Division

APPLICATIONS invited for following superannuable post. Conditions of service in accordance with N.J.M.C. Agreement. Salary includes London allowance. Qualifications entitling to Corporate Membership of I.E.E. or I.Mech.E. an advantage.

STATION SUPERINTENDENT,
BELVEDERE (Erith, Kent)
POWER STATION
(Vacancy No. 58/91).

Applicants should have had suitable experience in a managerial capacity in a large modern power station. Commissioning of Belvedere should take place in latter months of 1958, and the ultimate capacity will be 480 MW. Salary Class D, Grade 5 = £2,160/£2,360 per annum.

Applications, quoting vacancy number, to (or on form from) Central Electricity Generating Board, London Division, P.O. Box 135, London, W.1, by 24th February, 1958. 2358

AIR MINISTRY

WORKS Design Branch requires in London and Provinces ELECTRICAL ENGINEERING DRAUGHTSMEN experienced in preparation of schemes for illumination and electrical equipment of buildings or in electrical distribution, H.V. and M.V. Technical training to O.N.C. standard or equivalent an advantage.

Salaries in LONDON up to £1,015 per annum. Somewhat lower in PROVINCES. Starting pay dependent on age, qualifications and experience. Long-term possibilities with pensionable and promotion prospects. 5-day week, 3 weeks 3 days leave a year.

Liability for overseas service. Normally natural-born British subjects.

Write stating age, qualifications, employment details, including type of work done, to any Employment Exchange, quoting Order No. Borough 104. 257

ELECTRICAL ENGINEERS

required for Technical Estimating Department of Automatic Motor Control Gear Makers in West Midlands, following further expansion.

The work comprises the initial engineering of control schemes, the calculation of their cost, and the preparation of tenders.

A pension scheme is in operation and assistance towards removal expenses will be paid in approved cases.

Apply in confidence, stating age, experience and salary required, to—Box 362.

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ASSISTANT CONSUMERS' ENGINEER required at Wrexham. Salary within range £685/£730 per annum (N.J.B. F.11).

Applicants should have had an engineering training and experience in dealing with installation work, consumers' supply enquiries and general commercial duties.

Appointment subject to medical examination. Pension scheme.

Application forms obtainable from the Manager, No. 4 Sub-Area, Electricity House, Rhostyllen, Nr. Wrexham.

Closing date 26th February, 1958. 2401

W. E. BURNAND & SON LIMITED
66-106, Shoreham Street, Sheffield, 1

EXCEPTIONAL opportunity offered to young man with sales experience and H.N.C. or equal qualifications as SALES AND SERVICE ENGINEER in connection with Electro-magnetic Clutches and Lifting Magnets. Successful applicant will be required to travel abroad following a suitable period of works training. This is a senior post carrying a substantial salary and non-contributory pension scheme.

Apply to Managing Director. 2363

***Situations Vacant** (continued)*

INSPECTOR OF WORKS (ELECTRICAL)

required by ADEN GOVERNMENT PUBLIC WORKS DEPARTMENT on contract for one tour of 18 to 24 months in first instance. Commencing salary according to age and experience in scale (including pay differential) £1,005 rising to £1,554 a year. Gratuity at rate of £150 a year. Outfit allowance £60. Free passages for officer and wife. Free passages for children or allowance up to £288 annually towards cost education in U.K. Liberal leave on full salary.

Candidates must possess wide experience of maintenance of domestic electrical installation and air conditioning equipment.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2C/42611/EF. 2340

MINISTRY OF EDUCATION

requires, for England only, H.M. INSPECTORS (men and women). Preferably under 50. Good educational qualifications and teaching and practical experience in achitecture, building, applied chemistry, applied physics, engineering (mechanical, civil and electrical) or commerce.

Permanent posts, non-contributory pension. Salary, London (men) (£1,525 (11 increments) to £2,250, elsewhere slightly less. Appointments may be made above minimum. Higher posts filled by promotion; also some with £140 allowance.

Application form from Secretary (Inspectors' Section), Ministry of Education, Curzon Street, London, W.1.

Closing date 3rd April, 1958. 2389

DRAUGHTSMAN

SPLENDID opportunity for ambitious young man with ability, drive and urge to succeed, required to join team of designers engaged on development work in a specialised engineering industry.

Applicant will be required to take sole charge of a section responsible for design and specification of electric and electronic control equipment.

Workshop experience would be an advantage. Superannuation and life assurance schemes in operation.

Applications, which will be treated in strict confidence, stating full details of experience, qualifications, etc., and salary expected, should be addressed to Personnel Manager, Rose Brothers (Gainsborough) Ltd., Gainsborough, Lincs. 2343

ELECTRIC TRANSMISSION LIMITED
Newstead, Trentham, Staffs

APPLICATIONS are invited for the position of SENIOR ELECTRICAL ENGINEER. Applicants should possess a sound technical training, including university degree in science or engineering, and/or Corporate Membership of the Institution of Electrical Engineers.

Successful candidate would be responsible for the design, development and testing of high-voltage H.R.C. fusegear and high-voltage heavy current airbreak switchgear.

Salary would be commensurate with qualifications and experience.

Write, stating age, qualifications, details of experience and salary required to the General Manager. 2305

DESIGNER OF INDUSTRIAL LIGHTING EQUIPMENT

Applications for the above appointment are invited by

THE BENJAMIN ELECTRIC LIMITED.

Knowledge of fabricating techniques, finishes, lamps and control gear desirable, but initiative and ideas equally important.

The vacancy carries excellent prospects, with appropriate salary according to age, experience and qualifications. Staff luncheon room and pension scheme.

Apply Chief Technical Engineer, Brantwood Works, Tottenham, London, N.17. 177

A LIGHTING sales engineer, expcd., reqd. by old-established manufacturer, covering Lancs. and Midlands. Full details past expce.; present employers (no contact will be made without applicant's permission); age; salary reqd. Permanent post with £30,000 t'over. All expenses paid.—Box 2365.

APPLICATIONS are invited for position of technical sales engineer for London and Southern England. Applicants must have good electrical engineering background and basic knowledge of motor control equipment in all its applications, and must have good existing connections with users in the area concerned. Please write giving full particulars to Sales Director.—Box 2279.

APPLICATIONS are invited from men trained to at least Higher National level to undertake research and development work at a high level of responsibility in mechanical side of larger capacity circuit breakers and switchgear. Reply giving full particulars of age, experience and salary required to—Box 2306.

AREA representative required Birmingham district by manufacturers of specialised industrial electrical appliances. Position calls for basic knowledge of electrical equipment and fan performance, ability to evaluate problems and to submit recommendations. Industrial connections essential. Please submit particulars to—Box 2267.

ARMATURE winder. Progressive firm requires for repair shop winder having sound knowledge all types A.C. and D.C. work. This company has other activities and there are good prospects of advancement for skilled man with initiative and some administrative ability. Write to—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. 2403

ASSISTANT works manager required for electric cable works, paper-insulated section. Reply with full details of past experience to the Managing Director, Sterling Cable Company Ltd., Aldermaston, Berkshire. 2251

BRITISH ENGINE BOILER & ELECTRICAL INSURANCE Co. Ltd., 24, Fennel Street, Manchester, 4. Electrical surveyors required for various districts in Great Britain. Permanent positions carrying progressive salary scale £735 to £1,060 and non-contributory pension. Candidates, age 26 to 32, preferably with H.N.C. in Electrical Engineering or Grad. I.E.E., and with apprenticeship in manufacture or repair of electrical machinery, are invited to apply in own handwriting, stating age, qualifications and experience. 2376

CIRCUIT design draughtsmen required by company manufacturing industrial control equipment. Good salaries paid to "first-class" men. Canteen facilities, pension scheme. Housing assistance considered in approved cases. Write giving age, experience, etc., to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Works, Inverness Road, Hounslow, Middx. 273

CONTACTOR designer required, preferably with experience on contactors up to 400 volts and currents of up to 1,600 amps. Reply in strict confidence to—Box 2332.

CONTRACTS engineer required for interesting work on specialised electrical equipment. Good prospects with a small firm in N.W. London for a young man with experience in automatic control gear.—Box 2163.

DESIGNER required for development work on low-voltage air circuit breakers. Reply in strict confidence to—Box 2333.

DEWHURST & PARTNER Ltd. require technical estimator for preparing tenders in their estimating engineering department. Applicant must have good electrical engineering background and have basic knowledge of motor control equipment and its applications. The position is a senior one, and housing assistance will be given to successful applicant if necessary. Canteen facilities, pension scheme. Write giving age, experience, etc., to — Personnel Officer, Dewhurst & Partner Ltd., Inverness Works, Inverness Road, Hounslow, Middlesex. 274

DRAUGHTSMAN, electrical, with experience of sheet metal work, required. Position is permanent and pensionable. Write Chief Engineer, Astral Switchgear Ltd., Alma Road, Ponders End, Enfield, Middlesex. 2252

ELECTRICAL engineer interested in problems associated with design of high-voltage cables. Age 21-30. Degree standard. Good pay and prospects for man with initiative. Pension fund and other amenities. Apply to—Staff Officer, BICC Ltd., Belvedere, Kent. 2404

DRAUGHTSMAN wanted for mechanical engineering work and pressure vessel design. Good prospects, superannuation scheme and pleasant working conditions.—Bastian & Allen, Ferndale Terrace, Harrow. 2164

ELECTRICAL contractors in Bradford, dealing mainly in large industrial contracts, require an experienced male clerk able to deal with costings and charging out of electrical work and wiring contracts. This is a responsible position in a progressive firm, and some knowledge of electrical contracting is essential. Please write in confidence giving age and details of previous experience to—Box 9267.

ELECTRICAL contractors (Bradford, Yorkshire area) require an experienced engineer to handle estimates, etc. Reply giving age, experience, salary, etc.—Box 2346.

ELECTRICAL engineer required, aged 25 to 40, capable of designing and supervising electrical engineering installations for all types of buildings. Apply, with details of experience and salary required, to — J. Stinton Jones and Partners, Consulting Engineers, 21, Gloucester Place, London, W.1. 2348

ELECTRICAL engineer required at English Numbering Machines Ltd., Queensway, Enfield, Middx., for design and development of electro-mechanical devices. Must be capable draughtsman and prepared to carry job through to final production. This is a progressive post for a suitably qualified man. Apply Personnel Officer. 2347

ELECTRICAL engineer required by W. J. Furse & Co. (Manchester) Ltd., 20, Mount Street, Manchester, 2, as manager for South Wales branch. Good prospects for right man; must be capable of increasing turnover consisting of heavy electrical and other contracts, controlling office and outside labour. Apply to Mr. J. K. Furse, stating qualifications, experience and age. 2366

ELECTRICAL engineers required for development work on capacitors. Those interested in problems of insulation and dielectrics which offer great scope for experimental research should write to—Stability Capacitors Ltd., Raven Road, London, E.18. 2334

ELECTRICAL/mechanical engineer (assistant) required for alluvial gold mine in British Guiana. Age about 25/35, preferably single, with good practical experience particularly on electrical side in operation and maintenance of diesel power plant, hydro-electric plant and dredging equipment. Free accommodation; inclusive starting salary £1,050 to £1,250 p.a., depending on experience; kit allowance; pension scheme; free passages; generous leave on full pay; tours of duty 2½ years. Apply giving age and full particulars to — Personnel Officer, Colonial Development Corporation, 33, Hill St., London, W.1, quoting Serial 326. 2388

ELECTRICAL wholesalers require representative for S.E. London and City areas. Must have intimate knowledge of electrical trade.—Phone, BIS. 4356. 2309

ELECTRO-mechanical draughtsmen required for production drawing office of company engaged in the manufacture of control gear equipment. Good salaries paid to "first-class" men. Canteen facilities, pension scheme. Housing assistance considered in approved cases. Write giving age, experience, etc., to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Works. Inverness Road, Hounslow, Middx. 275

EXPERIENCED draughtsmen of O.N.C. or H.N.C. standard required for interesting design work on process plant and machinery. A good technical background and knowledge of machine design is essential and applicants should be qualified to H.N.C. standard. Salaries are assessed in accordance with age, qualifications and experience and will be reviewed annually. Contributory superannuation and widows' pension fund are in operation and there are excellent canteen, welfare and recreational facilities. Applicants should apply in writing to Group Personnel Department, Pilkington Brothers Limited, Grove Street, St. Helens, Lancs, enclosing a brief history of their career and details of their education and qualifications. 2310

FOREMAN maintenance and installation electrician required for large factory in Kent. Must have thorough knowledge of both A.C. and D.C. control gear. Only applicants who have served in a supervisory capacity need apply. Write giving full details of previous experience and earnings. State salary required. —Box A.744, c/o Central News Ltd., Pemberton House, East Harding Street, London, E.C.4. 2253

IMPERIAL CHEMICAL INDUSTRIES Limited, Plastics Division, has immediate vacancies for electrical draughtsmen in the Chief Engineer's Department at Welwyn Garden City. Candidates must have served a recognised apprenticeship, and should hold the Ordinary National Certificate. Experience of factory and general industrial installation work would be useful. An attractive starting salary will be offered to the selected applicants, beyond which there is plenty of scope for progressive remuneration. The appointments carry membership to the staff pension fund and a profit-sharing scheme is in operation. For married men special mortgage facilities can be granted towards house purchase, and assistance is given towards removal expenses. Temporary lodging allowances are also available for married men. Apply giving full particulars to the Staff Manager, Imperial Chemical Industries Ltd., Plastics Division, Black Fan Road, Welwyn Garden City, Herts. 2405

JOINTER (extra high tension) required by London Electricity Board in South Eastern District, based at Woolwich, S.E.18. N.J.I.C. wages and working conditions, 4s. 11½d. per hour (£10 18s. 2d. per 44-hour 5-day week). Application forms obtainable from Personnel Officer, 46, New Broad Street, London, E.C.2. Please quote ref. PER/6307/R. 2406

JUNIOR plant efficiency engineer required in Manchester by consulting engineers to assist with the testing of plant installed in thermal, nuclear and hydro-electric power stations. Applicants should have had a thorough mechanical engineering training and have attained or be studying for the Higher National Certificate. An interest in thermo-dynamics and workshop practice, and experience as a draughtsman, would be an advantage, and the salary will be related to age and experience. Application forms should be applied for in writing to—Staff Appointments, Kennedy & Donkin, 813a, Wilmslow Rd., Didsbury Manchester, 20. 2350

JUNIOR technical assistant required for investigational work in cable factory. H.N.C. preferred but O.N.C. with some experience would be considered. Apply giving age, qualifications and experience to—Box 2367.

JUNIOR technical engineers and draughtsmen required for work on design of electrical engineering installations for hospitals, colleges, factories, etc. (5-day week). Salary dependent upon age and experience. Apply, with details, to—J. Stinton Jones and Partners, Consulting Engineers, 21, Gloucester Place, London, W.1. 2349

LONDON consulting engineers require electrical engineers for installation design for hospitals, commercial buildings, schools, etc. Write stating age, qualifications, experience and salary required to—Box 160.

MANCHESTER CORPORATION TRANSPORT Department require technical assistant (electrical) with H.N.C. or equivalent. Salary £575 to £725 per annum. Details and forms from—General Manager, 55, Piccadilly, Manchester, 1, returnable by 19th February, 1958. 2407

OPPORTUNITY offered to young man with electrical background to join the sales staff of an established firm of electric motor manufacturers in London.—Box 2351.

REPRESENTATIVE for Yorkshire for TEMCO wiring accessories. Good salary, commission, expenses, for experienced man with personality and contractor connection. Car provided. Pension scheme. Write in confidence stating experience, age, remuneration required, to—Mr. S. M. Harris, T.M.C.-Harwell (Sales) Ltd., 37, Upper Berkeley Street, London, W.1. 2311

SALES engineer for London area. Salary £900/£1,000 plus commission. Excellent opportunity for promotion. Electrical engineering apprenticeship an advantage but not essential. Apply in confidence stating age, qualifications and past experience.—Box 2408.

SALES order clerk required, senior post. Well paid position offering scope in the future. Superannuation scheme. Canteen and social club facilities. Experience of electrical wholesaling essential. Apply—Managing Director, Halsey's Electric Co. Ltd., Brandon House, Wyfold Rd., London, S.W.6 (Tel. Fulham 3355). 2409

SUPERVISOR required by London electrical engineers specialising in industrial installations. Applicants must be capable of interviewing, estimating, supervising contracts and preparing invoices. Write stating age, salary required and experience to—Box 2410.

SENIOR planning engineer required by old-established company manufacturing F.H.P. electric motors. Sound electrical and mechanical knowledge and experience of batch production methods essential. Position offers excellent prospects of promotion. Write stating age, experience and salary required.—Box 2353.

SENIOR technician required immediately for engineer's department, physics workshop. Knowledge of electronics, physics and general workshop technique desirable. Salary £600 × £25 to £775 p.a. plus London weighting. Write stating age, qualifications and experience to Chief Engineer, The Middlesex Hospital, London, W.1. 2377

SETTER mechanic with experience of automatic packaging machine required for a well-known pharmaceutical company, N. London. A generous non-contributory pension scheme is in operation and a good starting salary with regular reviews is offered. Apply, giving full details and present salary, Personnel Manager. —Box 2370.

SURVEYOR required for wood pole line contract in Inverness area. Good salary and subsistence to right man. Apply in writing to—B. French Limited, Pike Mills, Kidderminster. 2352

SWITCHGEAR sales engineer required for estimating and contracts work. Applicant must have experience of 11 kV switchgear. Previous sales experience desirable, not essential. Vacancy is at Amersham but applications for London would be considered. Five-day week, bonus and pension schemes. Apply in writing with full details stating salary required. —Sales Manager, J. G. Starter & Co. Ltd., 82, Victoria Street, London, S.W.1. 2224

SWITCHGEAR sales engineers required, preferably with H.N.C. or higher qualifications and with experience in tendering for E.H.V. switchgear installations and power station auxiliary applications. Applications to give age, education and full details of experience, together with salary required, to—Personnel Manager, South Wales Switchgear Ltd., Blackwood, Mon. 2371

TECHNICAL assistant (electrical) required for Central London office for the design and layout of complete factory electrification schemes, including generation and/or public supply. Successful applicant would be required to specify and purchase electrical equipment, cover technical correspondence and consultative work, and witness manufacturers' works tests and site tests. Applicants should be between 25 and 30 years old, and must hold the H.N. Certificate in Electrical Engineering (preference given to A.M.I.E.E. or Grad. I.E.E.). Five-day week. Superannuation scheme. Salary according to experience. All applications will be treated in the strictest confidence and should be addressed to—Head Office Staff Department (WF 23), Unilever Limited, Unilever House, London, E.C.4. 2369

TECHNICAL engineer required in development department of cable works. University degree essential and should have completed National Service. Some experience of cable and dielectric problems an advantage. Apply giving full details to—Box 2368.

TECHNICAL sales assistant required by old-established specialist F.H.P. motor manufacturers in Croydon area, for editing orders and enquiries. Experience in F.H.P. motor field essential. Please write giving details of previous employment, salary required, etc.—Box 2354.

TESTER of automatic electric control equipment required. Interesting work with good prospects. O.N.C. standard preferred. Five-day week, pension scheme, canteen facilities. Please write giving full details of age, previous experience, qualifications, etc., to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex. 277

TWO lighting sales representatives required for London area. Only salesmen experienced in selling to industrial and commercial users with proved sales records may apply. Salary and commission. Car provided or contribution made to car owners. Apply to—Secretary of Ensel Electric Co. Ltd., 3, Eden Grove, London, N.7 (Phone, North 5866). 2415

WEATHERLEY OILGEAR Ltd. require an electrical engineer for their drawing office electrical division, with prospects of taking charge. Minimum qualification H.N.C. Write in confidence, giving details of experience, qualifications, age and salary required, to—Personnel Officer, Weatherley Oilgear Ltd., Dells Lane, Biggleswade, Beds. 2411

TRANSFORMER designer, experienced up to at least 1,000 kVA. Salary according to qualifications and experience. Write with full details of career and salary expected to—Box 2269.

YOUNG electrical engineer required as trainee transformer designer. Practical experience of transformer manufacture preferred but not essential. Education to at least H.N.C. standard. Write with full details of career to—Box 2270.

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

B.Sc., A.M.I.E.E., 20 years' experience applications motors, automatic control gear, tenders, estimates, installation, administration, seeks change.—Box 9257.

ELECTRICAL engineer (contracting) seeks senior appointment with reputable company, where drive, initiative and real ability are essential qualifications.—Box 9262.

ELECTRICAL engineer having spent the last ten years in the East desires change. Estimating, planning, supervision of power and lighting installations, power houses, factories, public buildings, o.h. & u.g. distribution systems. Prepared to travel home or abroad.—Box 9259.

ELECTRICAL engineer, Scot (32), married, excellent health, H.N.C., Heriot Watt, Edinburgh, wishes responsible overseas position with reputable organisation. Has sound knowledge of repair, fault location, installation and maintenance of A.C. and D.C. machinery and control gear. Advertiser spent four years in Middle East engaged on fault location and repairs of all sizes and types of equipment, also power station installation work, including all controls, auxiliaries, etc., in M.I.C.C. Is interested in foreign languages and speaks Farsi fluently. At present resident in New Zealand, but could arrange for interview at any particular place.—Box 9264.

ELECTRICAL engineer, 30 years in East, desires work in Home Counties. Design, specifications, supervision of power, lighting and air conditioning installations for factories, laboratories, multi-storey buildings.—Box 9266.

ESTIMATING and supervising engineer desires change.—Box 9263.

STORES clerk (39), Electricity Board, Grade 2, seeks post in other Board with scope for advancement. Thoroughly acquainted all stores procedure to District level.—Box 9254.

TECHNICAL sales engineer (43), 20 years in Midl'ds present co., seeks change.—Box 9258

TWO electricians (supervisors) desire overseas contracts.—Box 9251.

WORKS manager estab. rewind/repair works (32) seeks similar position.—Box 9265.

YOUNG electrical engineer, aged 25, apprenticed, passed installation and technology exams., experienced with light and heavy electrical plant installation and maintenance, studied term of estimating on electrical work. Keen to obtain good position. London area preferred. —Box 9261.

YOUNG man aged 28 with 14 years in electrical contracting, including experience at ordering and pricing, seeks position as trainee estimator, London area.—Box 9268.

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ELECTRIC HOUSE SERVICE METERS

PREPAYMENT and credit, 200/250 v. A.C., 1/p., 50 c., 2½-100 A. Fixed or variable tariff. Reconditioned, fully tested and guaranteed 2 years. Prompt delivery, carriage paid.

ALBERICE METER COMPANY
Fairfax Works, Fairfax Rd., London, N.8
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3,500-kVA INDOOR TRANSFORMER

3-phase, 50 cycles, by HACKBRIDGE; ratio 6,600/11,000 volts, with tappings (2 available).

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H.p.	Make.	Speed.	Encl.	
25	CROMPARK.	960	S/P	£48
25	" "	1450	S/P	£44
15	" "	950	T/E	£38
10	" "	1440	S/P	£24
25	BRUCE PEEBLES	1450	S/P	£44
4	" "	1450	S/P	£18
5.5	L.D.C.	1450/470	S/P	£26
15	"	975	T/E	£38
15	"	720	S/P	£34
7.5	E.E.	950	T/E	£22
15	"	970	S/P	£30
5	"	955	S/P	£20
2	"	1440/72	T/E	£28

(Geared Unit)

Slipring, Half-hour Rated

12.5	L.S.E.	Speed 940	£24
15	"	" 950	£28

All 400/440 volts, 3-phase, 50 cycles, overhauled and guaranteed.

ELECTRICAL EQUIPMENTS (CARDIFF) LTD.
Tresillian Engineering Works
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2199

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MET.-VICK. Low Tension Switch Panel Cubicle Type Switchboard for 400/3/50, 4-wire.

2 1,200-ampere; 3 600-ampere and 3 500-ampere Oil Circuit Breakers with Ammeters, Voltmeters, Power Factor and Max. Demand Meters. Also Bus-section coupler between 1,200-amp. breakers.

ALL EQUIPMENT RATED at 25 mVA on 400-volt supply. Manufactured 1941.

WILL SELL SEPARATE.

Full details and specification from—

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778, New Hey Road, Huddersfield
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ONE 1950 BROOK, 85 h.p., 1,450 r.p.m., 415/3/50, with pedestal bearing. Complete with ELLISON hand-operated resistance starter and pulley and belt drives. £200.

One 1944 L.D.C., 80 h.p., 975 r.p.m., 415/3/50, with E.A.C. hand-operated resistance starter. £165.

One 1944 L.D.C., 37.5 h.p., 1,445 r.p.m., 415/3/50, with E.A.C. hand-operated resistance starter. £85.

Ex temporary pumping stations. In first-class working order.

Apply P. H. Ogden, B.Sc., M.I.C.E., M.I.W.E., West Hampshire Water Company, 21, Stour Road, Christchurch, Hants. 2372

ABABCOCK & Wilcox water tube boiler will cut down your fuel costs; we can supply from stock. Two 40,000 lb. evap., 220 lb. w.p.; one 25,000 lb. evap., 200 lb. w.p.; 3,000 lb. evap., 400 lb. w.p.; Spencer Bonecourt boiler: also Marine. Cornish vertical, etc.—Burford, Taylor & Co. Ltd., Boiler Specialists. Burtayco House, Church Street, Middlesbrough (Tel. Middlesbrough 2622). 122

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9). 91

A.C. and D.C. 1/- Slotmeters. Guaranteed 2 years. 2½-50 amps. From 50/-. Repairs and recalibrations. See Billiard: Tradex Meter Co., Surbiton (Tel. Elmbridge 4487). 160

ALTERNATORS, generators, 1-100 kVA, all voltages. Specialists—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 147

ALTERNATORS. Surplus to requirements on account of change in design of our generating plants. Attractive prices. 0.5 kVA to 25 kVA. Send for list and also details of our comprehensive range of diesel and petrol generator plants from 0.5 kVA to 200 kVA.—Dale Electric (Yorkshire) Ltd., Filey, Yorks. (Phone 2301-3). 2049

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 20/26, Britannia Walk, London, N.1 (CLErkenwell 5512). 24

ALTERNATORS from ½ to 675kVA in stock, single and three-phase, all voltages and frequencies. Guaranteed. Many unused. Send your requirements.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 162

BARGAINS in electric motors are always being obtained from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Stocks include A.C. and D.C. motors, second-hand and new up to 30 h.p. Starters, slide rails and pulleys. Ring Mon. 3355 for your requirements. 50

BILLIARD Meters. 1/-, 6d. or 1d. slot. All time settings. From 140/-. See Quarterly.—Tradex, Surbiton. 170

B.T.H. 8-h.p., 1,440-r.p.m., ball-bearing, continuous rated flameproof motor for sale, 440 volts, 3-phase, 50 cycles. Mounted on cast iron baseplate. Photo, etc., from F. J. Edwards Ltd., 359, Euston Road, London, N.W.1. 2335

CABLE, underground, all types ex stock.—E. M. Tatton Co. Ltd., Kew Bridge, Brentford (EALing 3155/6). 117

CABLE, underground, PILC/VIR/LC, ex London stock. Cutting orders same day delivery London area. Send for priced stock lists.—Batt Electrical Co., 6, Dock Street, London, E.1 (Tel. ROYal 5905). 316

CIRCUIT breakers, various sizes in stock. A.C. and D.C., 200 amperes up to 2,000 amperes. Also dynamo and alternator switchboards.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 26

CONVERTERS, 110 and 220 v. D.C./230 v. A.C., .5 to 6kVA; also A.C./D.C. Special voltages at short notice.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 150

CRANE motors. Direct current, series wound or compound wound, all voltages. We have large stocks.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 22

DIESEL generating sets, all sizes to 500 kW. Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 16

DIESEL generator, portable, 65 amp., 230 v. A.C., 3 cyl. Lister, seen running.—Elmo Electric, 277, Eastern Ave., Ilford, Essex. 9272

ELECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned, with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 20

ELECTRIC motors, generators, control gear, transformers, A.C. and D.C., new and reconditioned; all covered with our usual 12 months' guarantee; large stocks available.—Electropower Co. Ltd., Kingsbury Works, Kingsbury Road, London, N.W.9 (Colindale 4621-2). 42

ELECTRIC motors, generators, motor generator sets, transformers, switchgear, etc., large comprehensive stock, overhauled and guaranteed. Copy of our Register, "Electrical Surplus," containing thousands of items of electrical plant, sent on request.—R. F. Winder Ltd., Belgrave Electrical Works, Leeds, 2. 54

ELECTRICIANS. Send for details Shaftesbury lightweight "Bantam" ladders. Top sections fitted with patent moulded rubber blocks, eliminate possibility of scratching or marking walls, fascias, and other painted or highly polished surfaces. Also available for immediate delivery, steps, platform steps, trestles, telescopic trestles, pole and builders-type ladders, and all sizes of two and three-section extension ladders.—Shaftesbury Ladders Ltd. (E.R.), 453, Katherine Road, London, E.7 (Phone: Grangewood 3363/4). 111

FLUORESCENT fittings, lamps, starters and control gear for home and export. Fully guaranteed by actual manufacturers. Send for catalogues.—The Anglo-American Electrical Company, Olive Street, Bury, Lancs. 245

FLUORESCENT tubes reconditioned and guaranteed as new for 7s. 6d. each. Free collection and delivery in Lancs and Yorks.—The Anglo-American Electrical Company, Bury New Road, Breightmet, Bolton, Lancs. (Telephone. Bolton 7251). 212

FRACTIONAL h.p. motors, new, ex stock, A.C./D.C., Universal, B.T.H., Delco-Remy, G.E.C., Fracmo, Newman, Scophony.—Jeary Electrical Co. Ltd., 5, Lamb's Buildings, London, E.C.1. 126

GENERATING plants, remote and M/F up to 10 kVA; also secondhand A.C. and D.C. sets up to 100 kVA, large stock all types. Special plants built at short notice.—Powerco Ltd., 312, York Road, London, S.W.18 (Tel. VAN. 5234). 151

GENERATING sets for sale, petrol, diesel and steam, from 1 kW up to 700 kW. A.C. and D.C. switchboards.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 163

HEAVY twin core cab tyre flex, 248/.018, by J. & P. Carries 100 amps. Several hundred yards on drums, unused. Cheap. View—Burleigh, Alpine Wks., Empire Way, Wembley (Phone 0211). 2170

HOUSE service meters, C. & H., Aron, E.A.C., 20-240 v. A.C., 1.-ph., 50 c., 2½ amps., 7s. 6d. each, 1s. 6d. postage; 5 amps., 17s. 6d.—Universal Electrical, 217-221, City Road, London, E.C.1. 37

MOTOR generator sets and converters, all sizes and voltages from ½ kW up to 500 kW in stock.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, City Road, London, N.1 (Tel. Clerkenwell 5512, 5513 & 5514). 12

MOTORS, starters, circuit-breakers. Huge stocks of all types, ½ to 300 h.p. Stock list or quote by return.—J. S. Ramsbottom & Co. Ltd., Bow St., Keighley (3774-5-6). 70

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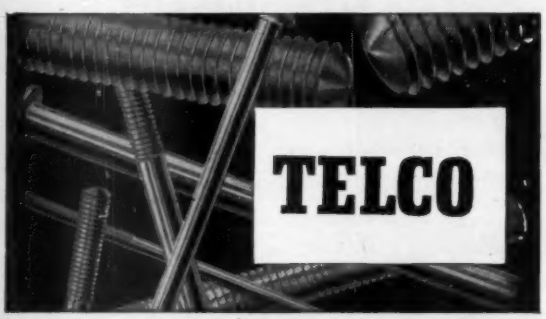

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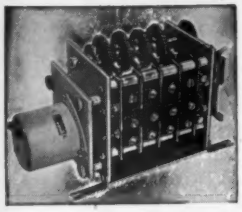

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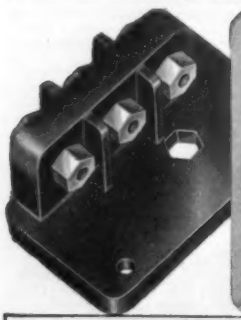

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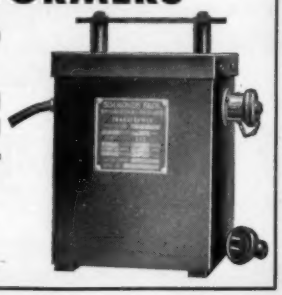

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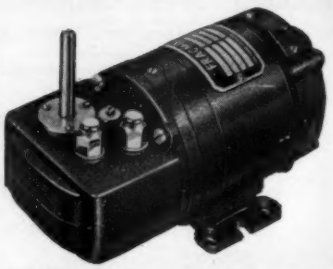

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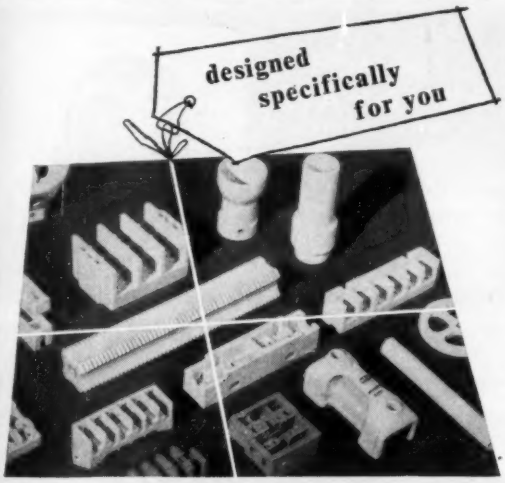

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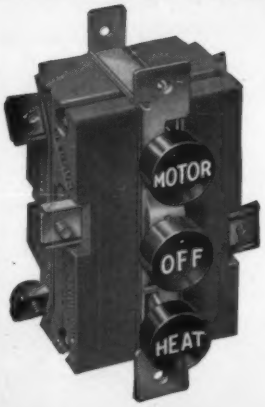

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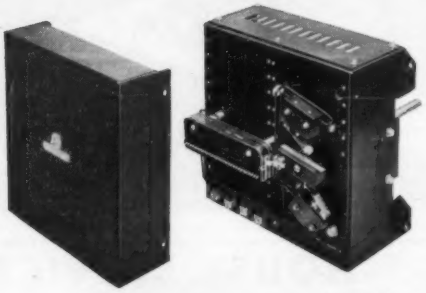

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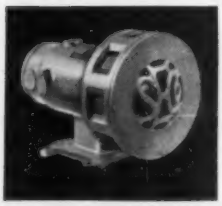
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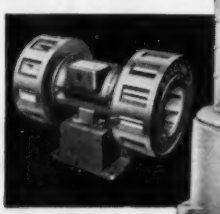
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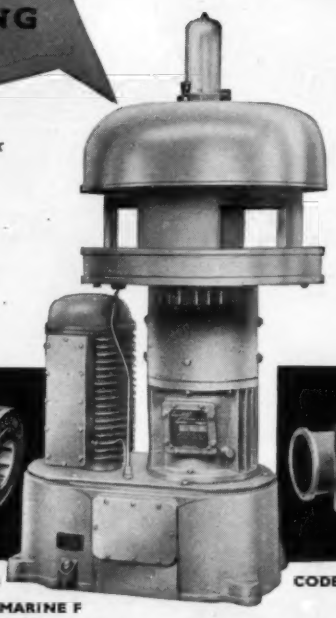
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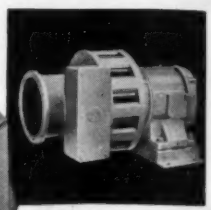
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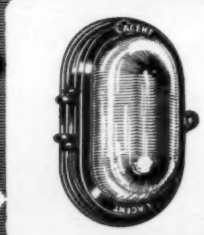

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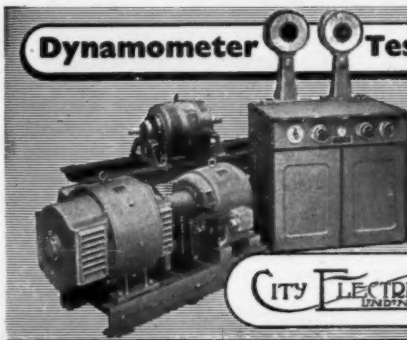

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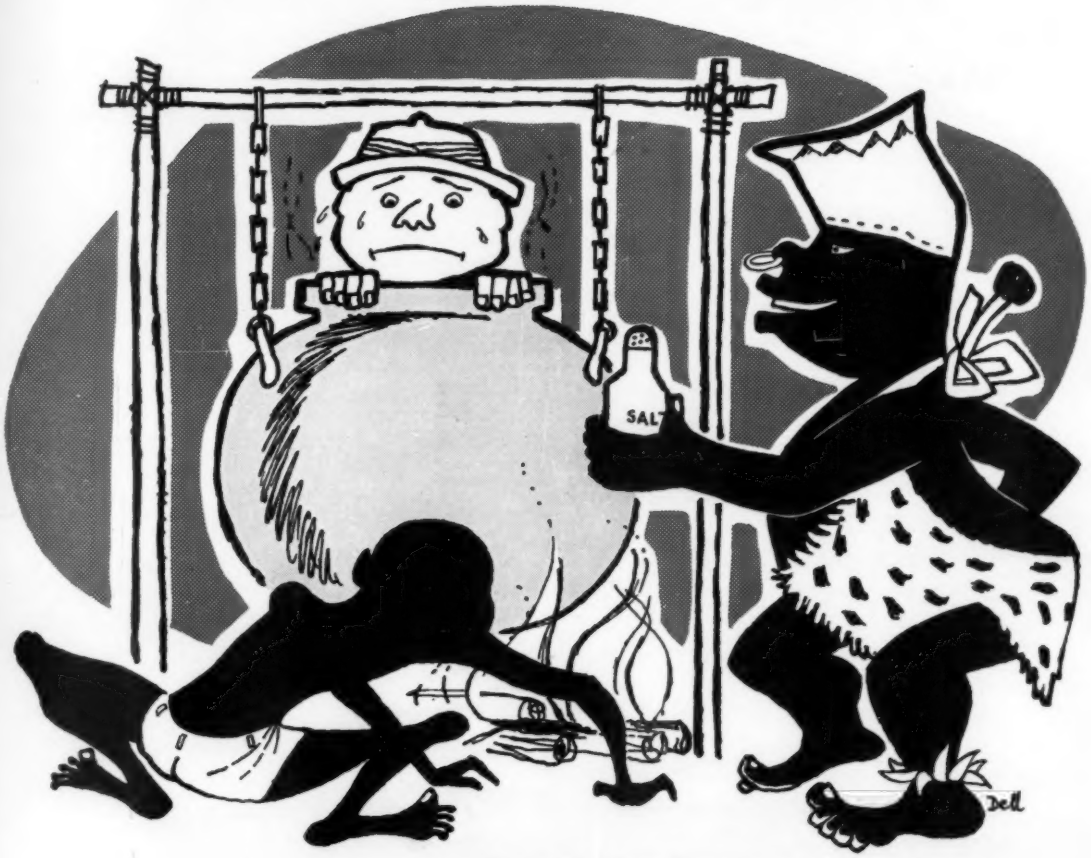

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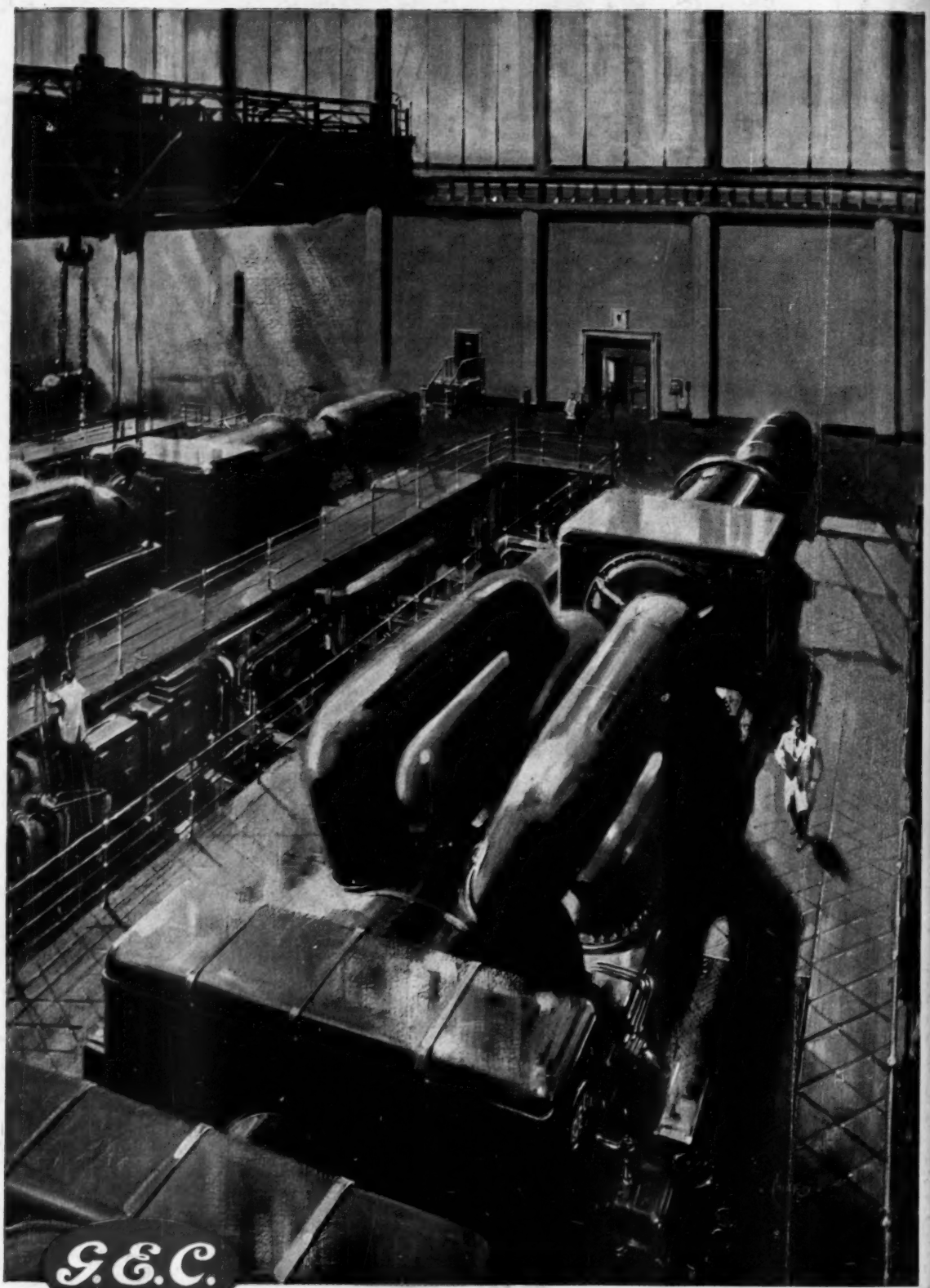

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